Volume 62

American Machinist

Number 1

New York, January 1, 1925

Leaders of Industry Look for Good Business in 1925

ALMOST without exception American industrial leaders are looking forward to a banner year in 1925. With a few exceptions American industries are already well on the upgrade. As is to be expected machinery manufacturers are trailing slightly behind the rest of the procession but underlying conditions are so favorable that it is inevitable that their day is coming. Confident that their opinions will carry weight with readers of the *American Machinist* we have asked some of them for the statements collected here.

Alfred P. Sloan, Jr.
President
General Motors Corporation

THE AUTOMOTIVE industry should enter 1925 with the greatest confidence. Prosperity of the farmer and the wage earner add greatly to the prosperity of the industry. Conditions, both economic and psychological, are such that the purchasing power of both should equal or be greater than 1924. This insures a good volume of business. As is generally known, 1923 was the largest year in our history. This year sales to consumers have been slightly less than last year. I see no reason why 1925, using the same measure, should not be equal to 1923.

As to General Motors, we enter the new year with our dealers' stocks at a normal level in relation to current consumers' demand. We have sacrificed profits in 1924 to effect this purpose, but we believe it was sound business. The carrying of unreasonable stocks in the field is simply an economic loss for which the consumer must pay in the final analysis.

General Motors recognizes that the tremendous increases in production which the industry has enjoyed during its development stage are certainly not going to continue at anywhere near the same pace. The problem now is to eliminate all possible waste in manufacture and distribution. I am confident that a more satisfactory business, taken on the whole, will be developed on that foundation with profits well maintained.

Charles M. Schwab
Chairman
Bethlehem Steel Corporation

IN LOOKING into the new year, it seems that there is every indication for a national and general prosperity throughout the United States, such as we have not witnessed for several years: Among the reasons for this, we have high wages for labor. As a whole, wages were maintained at constant levels last summer and fall, even in the face of considerably reduced production. With rates of production increasing, high wages will give a strong underlying buying power.

The farmer's dollar has been low in purchasing power for some time. Increasing prices for farm products will mean good business for those industries which sell directly or indirectly to our great farm population.

Manufacturers have spent the last two or three years studying their costs of production and distribution with a view to enabling the consumer to buy at the lowest possible prices. Unnecessary cots are being eliminated, methods of distribution improved. With even fair operations, manufacturers can show profits on their investment.

The railroads are recovering from the unusual stress put upon them during and after the war. Operating ratios are again in proper relation to income. The railroads are putting larger expenditures into upkeep which means a demand for a wide range of manufactured products. I think the public is beginning to have more confidence in the management of railroads.

Experts predict that the total volume of building will continue at somewhere near its present levels, and that automobile production will be equal to, if not beyond, the very large figures for 1924.

The American people showed by their vote in the November elections that they were in favor of government along the safe and sane channels that have been tried by time and found true. This edict of the people has given both confidence and impetus to business men all over the country to go ahead with production and normal expansion.

With such a wide diversification of favorable business signs, the expectations for the coming year speak for themselves. A business structure built on activity in every industry means national prosperity and good times.

A. L. Humphrey
President
Westinghouse Air Brake Co.

IT MUST be apparent to the students of economic conditions throughout the world that those factors upon which industrial activity depends present just now a more favorable aspect than they have for years. The reconstruction program carried on in Europe during the last five years as the result of the devastation of the World War was, of necessity, of a character more or less spasmodic. Happily, this condition has been improved

greatly, and a fresh impetus has been given to that work by the acceptance of the Dawes Reparation plan by the Allied Countries.

Apart from these demands that will come to this country from foreign sources, the outlook for our domestic business is promising. Every phase of activity upon which production depends seems to be in excellent shape. The sound financial conditions prevailing inspire American business, which has implicit faith and confidence in the present administration in Washington, and are bound to give an incentive to all industries and enterprises.

As to the business of our own domestic and foreign companies, we are more sanguine of the future than we have been for years, with every indication that the transportation business of our country is entering upon a long delayed period of reconstruction, improvements, and further development, especially so far as the railroads are concerned.

As for definite figures, I regret that at this moment they are not available, but indications point strongly to 1925 being one of the banner years in the history of this organization.

Charles G. DuBois
President
Western Electric Co., Inc.

I EXPECT that industry generally will be somewhat more active during 1925 than 1924. Our volume of business in 1925 will probably exceed that of 1923, but will be less than the high mark we reached in 1924. This is due largely to special circumstances in our own trade. I do not expect a greater volume or export business than in 1923 and in 1924.

Otto H. Falk
President
Allis-Chalmers Manufacturing Co.

I BELIEVE the business outlook favorable for 1925, so far as our company is concerned. The volume of new business obtainable in 1924 was not fully up to that of 1923. With the political campaign out of the way and the existence of apparently sound economic conditions, there appears to be a greater feeling of confidence throughout the country. We are hopeful that this will mean good business generally, including that of our own company, in 1925.

W. L. Saunders
Chairman
Ingersoll-Rand Co.

The PROGRESS of industry during the coming year is decidedly encouraging. At present the machinery industry has felt no boom, but it is running along on an even keel, in some cases equal and in others somewhat below last year's average. This is true of both domestic and foreign business.

We expect the European markets to be more productive during the coming year than in the past because of the political and economic settlements that have been arrived at over there.

The foundation of business is sound. That foundation is made up mainly of the sound financial status of the country—the increase in bank deposits, including savings banks, the low rate for money, the large volume of credit available and the high reserve condition of the Federal Reserve Banks. It is furthermore strengthened by the fact that there is no great accumulation of stocks, manufacturers feeling the lessons of 1919 and 1920 and moving cautiously. These things, taken together with the prosperity of the farming industry, the activity of railways and the optimism which exists throughout the country, promise a substantial period of prosperity on lines that do not so far give any indication of inflation. Inflation is the red flag in the path of business progress.

Samuel M. Hastings
President
Dayton Scale Co.

CONFIDENCE is the ascendant note in American business life today. Re-established confidence is opening up the new year in a manner seldom seen heretofore by the business life of our country. Nineteen hundred and twenty-five will be a year of recovery and prosperity. Fear and hesitancy have disappeared—courage and optimism have taken their place.

Home consumption will be on a very large scale, and business organizations have been at work for some time perfecting their production plans for their field forces to take advantage of this situation. Foreign business will grow by leaps and bounds because of the spirit of optimism that now prevails throughout Europe in the settlement of their difficulties brought about by the acceptance of, and operation under, the Dawes Plan.

The abundance of capital in the United States will enable us to do much toward continuing the development of this spirit of optimism in foreign countries. We can give credit and help stabilize business throughout the world because of our large financial resources. Good wages, plenty of work, good prices for farm products, all start us off in the new year on a foundation of security and good will. The experiences of the near past ought to guard us against over-enthusiasm, speculation and inflation.

C. H. Morse
President
Fairbanks, Morse & Co.

A SURVEY of the progress of industry in the various branches in which Fairbanks, Morse & Co. is particularly interested, shows, in my opinion, a decided improvement for 1925 over both 1924 and 1923. Capital expenditures will be made more willingly by various industrials that have been holding back on further expansion and new developments.

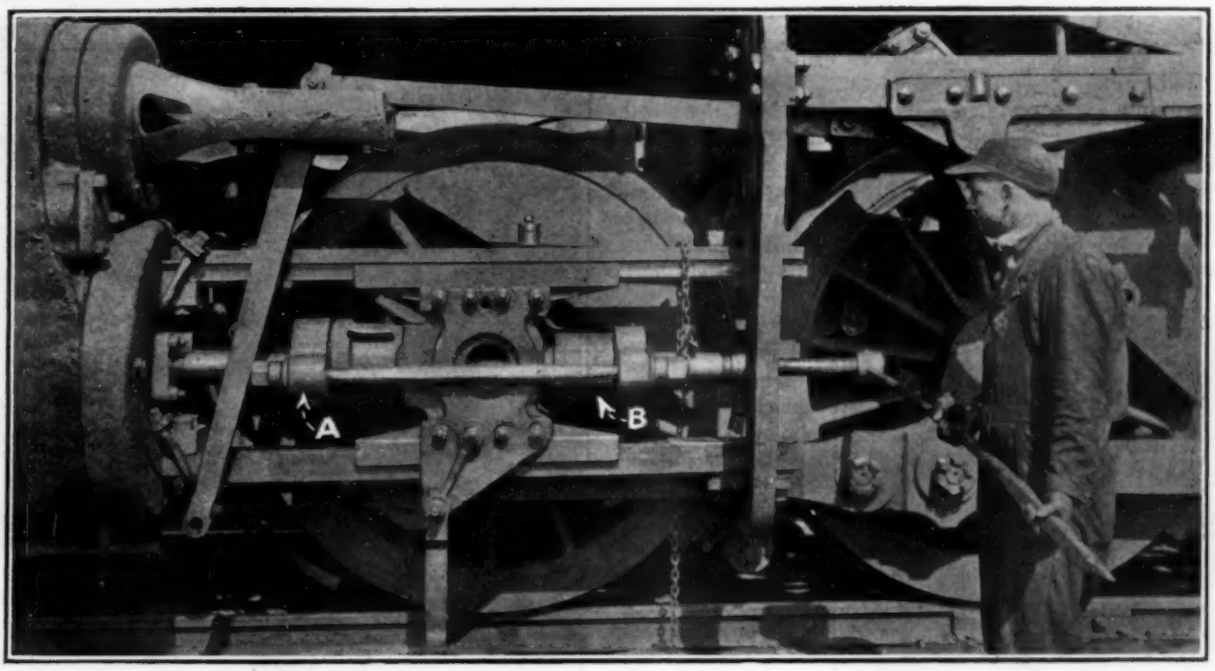
The agricultural interests should show a decided improvement in business not only because the farmer has postponed for the past two years the purchase of any new goods that he could do without, but also because dealers throughout the country have in the majority of cases been making an effort to reduce their stocks and liquidate their obligations.

I see no reason for expecting foreign business to be any greater proportionately during 1925 than the past two years but would expect it to maintain its ratio of approximately five per cent of our total business.

W. D. Baldwin
Chairman
Otis Elevator Co.

PRESENT INDICATIONS are that the volume of business in the elevator industry for 1925 will equal that of 1923. The building industry, in all parts of the United States, is governed, largely, by the prosperity and growth of its immediate locality. There will be some falling off of business in the Eastern states, but the South and West are in line for increased building development.

The foreign branch of the elevator industry is a small percentage of the whole. There is, however, an increasing demand for American elevators in the Orient. In Great Britain, and other European countries, there is practically no export business, our company operating, as it does, plants in England, France and Germany.



C. B. & Q. Shops at West Burlington

By Howard Campbell
Western Editor, *American Machinist*

Concluding article—Hydraulic presses for erecting-shop work—Drilling hub-plate holes—Special bench fixtures for odd-shaped parts — Flue-shop layout and methods

IT OCCASIONALLY happens that a piston rod sticks in the crosshead and has to be pressed out, which is done with the aid of a hand-operated hydraulic press as shown in the illustration at the head of this article. The key is removed, then the piece *A* is placed in position against the end of the crosshead and the cylinder *B* is bolted to it as shown, with the ram abutting against the end of the piston rod. The cylinder is filled with hard grease, which is compressed by the action of the screw, and the rod is forced out. The press, operated by one man as shown, has produced a pressure of 175 tons under test.

Another home-made hydraulic press is shown in Fig. 26. The pump is built with two cylinders, as shown, and is operated by an air-motor that delivers power through a gear and pinion to the eccentric shaft. Water is drawn through a hose from the shop water supply and is pumped into the press cylinder, as shown in the drawing, Fig. 27. The press cylinder is braced at one end of the locomotive cylinder and the front end of the ram passes through the bushing and through a plate from which it protrudes far enough to receive a nut, as shown. As the water is pumped into the press cylinder, the ram is forced back, pulling the bushing in with it. The four bushings can be pressed into the corresponding locomotive cylinders in an hour.

The first and second articles appeared in Vol. 61, pp. 905 and 989.

The operator shown in Fig. 28 is using a gage to set an eccentric crank. The pin *A* is a center that extends through the base of the gage and engages the center hole in the end of the axle, the pointer *B* being set to one-half the diameter of the throw-circle. When the pointer and the crank are swung to the position at which the end of the pointer meets the center hole in the rear end of the crankpin, the crank is correctly placed.

Drilling Hub-Plate Holes

Hub-plate holes are drilled in driving wheels by the aid of the machine illustrated in Fig. 29. The machine is an ordinary air-motor, attached to a base that rests on the journal, where it is held by a heavy leather strap. The strap is tightened by a ratchet and pawl arrangement, attached to the base of the motor. The motor is braced between the drill and a shaft that abuts the opposite wheel, and a ratchet provides means for feeding the drill.

In order to expedite the bench work, special fixtures are provided for holding parts that are awkward to hold in a vise, such as those shown in Fig. 30. The fixture *A* holds a brake valve, the fixture *B* is holding a straight-air valve and the third fixture, *C*, is holding a triple valve. Reference to Fig. 31 will show that the brake valve is held by a stud that passes through a hole in the fixture, where it is held by a lever-nut. The

straight-air valve rests in a pocket between two jaws that are drawn together and locked by a drift through a slotted stud.

The triple valve rests in a fixture especially designed for the piece, and is locked in position by a drift that passes over the piece and through the sides of the fixture. The cost of making such bench fixtures is small compared to the amount of time they save. Another handy bench-tool that can be used for holding various kinds of valves is shown in Fig. 32, holding a distributing valve. The threaded column *A* screws through the base, which is bolted to the bench. The lever *B* passes through a sleeve nut, fitting a stud that is an integral part of the work plate *C*. The work is attached to the work plate with a couple of cap-screws and the plate can be revolved to any position in a vertical plane by releasing the sleeve nut *B*, the threaded column *A* providing the necessary adjustment for height and for horiztonal position.

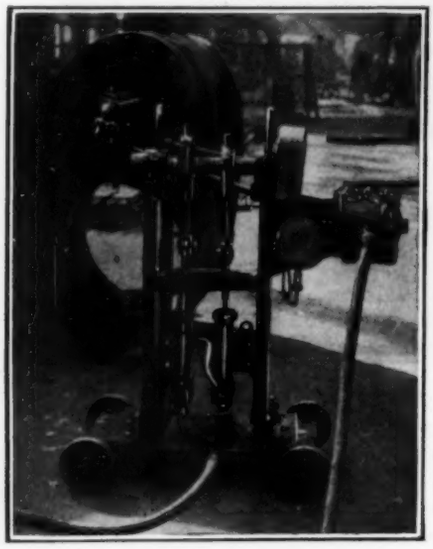


Fig. 26—Hydraulic press for cylinder bushings

The equipment of the flue shop is laid out as shown in Fig. 33. Tracks are laid as specified, so that the material can be transported on small flat cars pushed by hand. The boiler flues enter the shop through the door indicated and stop, first at the flue-cutter, where the fag ends are cut off. After cutting, they pass through the cleaners and are put back onto an empty

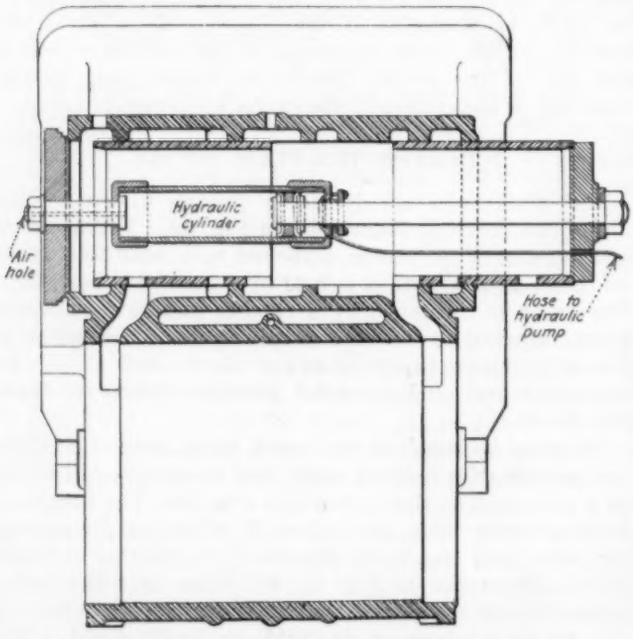


Fig. 27—Drawing showing operation of press

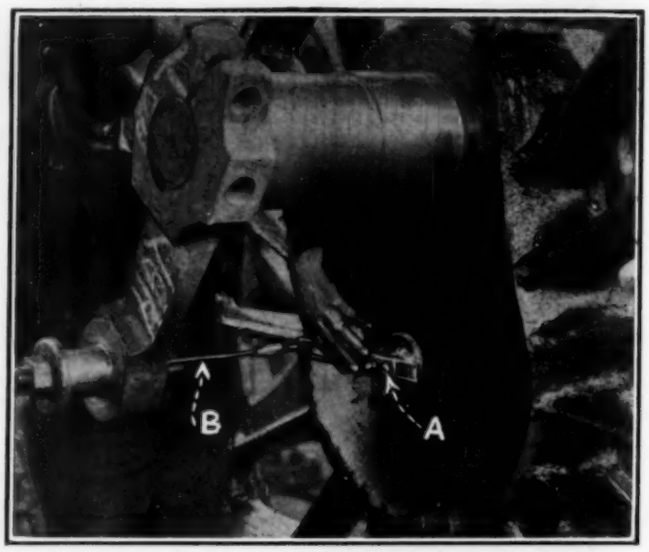


Fig. 28—Using eccentric-crank gage

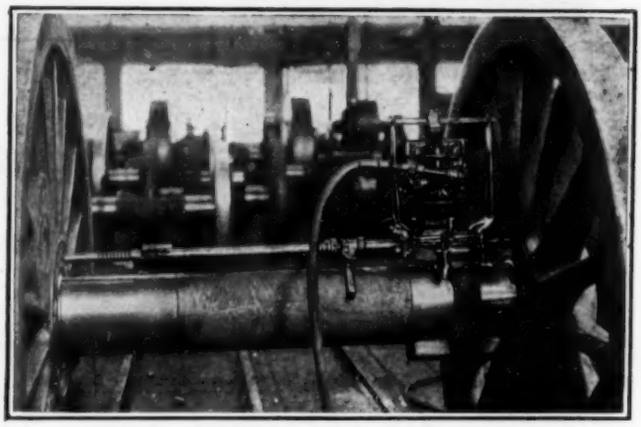


Fig. 29—Portable drill for hub-plate holes

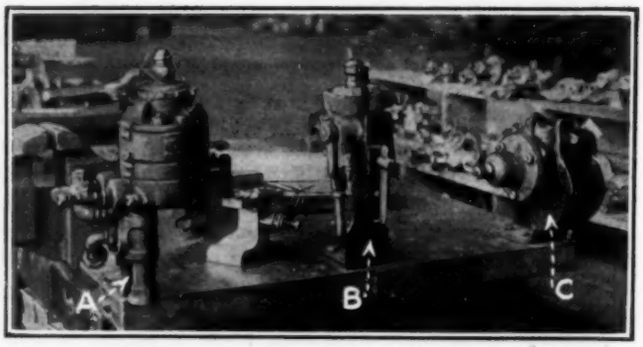


Fig. 30—Bench fixtures for odd-shaped parts

Fig. 31—Bench fixtures from opposite side

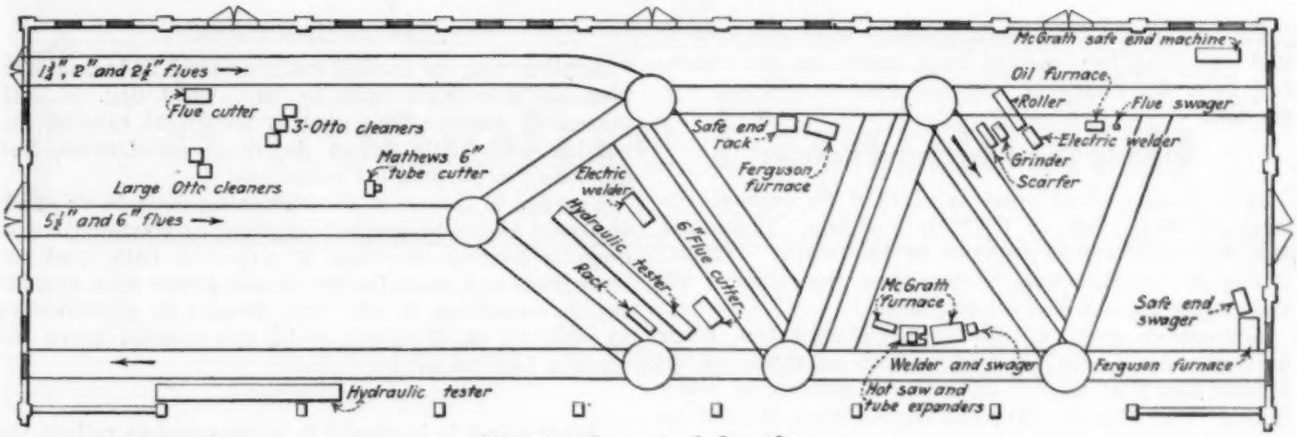


Fig. 33—Layout of flue shop

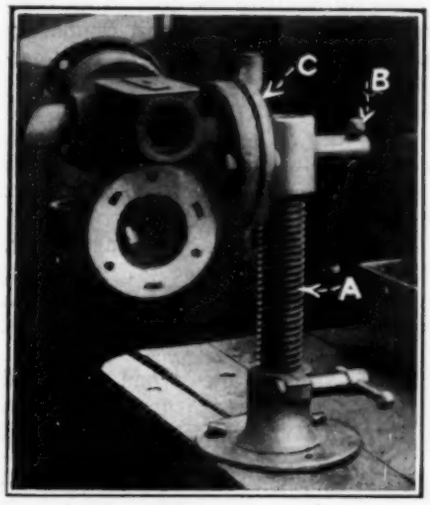


Fig. 32—A handy, adjustable bench-fixture

car for transporting to the scarfing operation. After the flues have been scarfed, they are polished a short distance back from each end and the safe ends are applied and electrically welded under compression. The flues are then tested in the hydraulic tester, after which they are removed, on the south track, through the same end of the shop from which they entered.

The superheater flues are brought in at the center door and pass to the cleaners and tube cutter, and then to the Furgeson furnace, where the ends are heated and 1¾ in. of each end swaged to the inside diameter of the safe ends that are applied in the next operation. The safe ends are shrunk on and electrically welded to the flues, the 1¾-in. overlap tending to make the flues absolutely safe. The flues are then tested under hydraulic pressure, after which they are cut to length and placed in a rack from which they are removed for use as required. The efficiency of both equipment and handling is evidenced by the reports on the work done, one of which is turned in each day. A number of reports selected at random read as follows: 155, 2¼-in. and 30, 5½-in. flues tested O. K.; 200, 2¼-in. and 34, 5½-in. flues tested O. K.; 291, 2¼-in. flues tested, one found with split in front end; 198, 2¼-in. flues tested, one bad; 283, 2¼-in. flues tested, four found split at front end.

Some Elementary Facts About Hardening

BY CHAS. DOESCHER
Foreman Hardening Room Scovill Mfg. Co., Waterbury, Conn.

ALMOST all shops have their hardening departments separate from the tool or machine room, and it is therefore not at all surprising that many mechanics do not have a thorough understanding of the essential points regarding the proper hardening of tools. For this reason the following review of elementary facts about hardening has been prepared.

IMPORTANCE OF MACHINING OFF ENOUGH STOCK

It is very important that every toolmaker, diemaker or machinist, who makes any kind of carbon-steel tool that is to be hardened should know that under the skin of every rough bar of carbon steel there is a carbonized surface that will not harden and it is, therefore, very important to order the stock, from which the tool is to be made, large enough so that the decarbonized surface can be completely removed by machining. A full $\frac{1}{32}$ in. or more on the side should be taken off.

There are times when a toolmaker will wonder why an arbor that has been hardened is soft along one side or at a small spot in the center. The reason is that, while he may have had enough stock allowance to get rid of the decarbonized surface, in the case of the soft side he did not center up his work true and on that account took off too much stock on one side and not enough on the other. The reason for the one soft spot in the center was that the piece was sprung and did not properly clean up in the middle.

ELIMINATING MAKING TOOLS OF WRONG STEEL

Many toolmakers and machinists have made tools of machine steel, thinking that it was tool steel. A mixup of this kind will occasionally happen in spite of all precaution. On expensive tools it pays to give the pieces of stock the spark test by lightly touching them against an abrasive wheel and noting the kind of sparks. A toolmaker who wishes to acquaint himself with the spark test should take a piece of steel that he *knows* is tool steel and another piece that he *knows* is machine steel and note the difference in the sparks.

The suggestion just made holds good with reference to high-speed steel tools, for it is an easy matter to mix carbon tool steel with high-speed steel. A carbon-steel tool or die is very apt to be badly burned if hardened as high-speed steel, at a temperature of 2,300 deg. F. Carbon steel is hardened anywhere from 1,400 to 1,490 deg. F., according to size and carbon content.

The difference between high-speed steel and carbon tool steel can be detected very easily by the spark, and both the diemaker and the hardener should use the test.

What Is Meant by Carbon Content

If a piece of tool steel is marked 90 carbon, the steel is 0.90 per cent or 90 "point" carbon. If marked 120, the steel is 1.20 per cent or 120 "point" carbon; it has 30 "points" more carbon than that marked 90, and can be hardened at a lower heat.

Low-carbon steel, say 70- to 80-point carbon, when used for die work, is mostly used on stamping or similar dies that have to withstand the shock of heavy blows. The 110- to 120-point carbon steel is used on cutting dies, such as blanking, clipping and piercing dies. It is therefore essential that when a toolmaker sends a tool to the hardening room he put on his hardening ticket not only the kind of steel, but the carbon content.

The Structure of Tool Steel After Hardening

The appearance of the fracture of a piece of hardened tool steel that has been broken off after hardening will tell the story as to whether the piece has been properly hardened or not. If the structure is silvery and gives the appearance of velvet, it is proof that the piece was properly hardened. If the structure is coarse and open-grained, we know that the piece was overheated in hardening, assuming that the steel was all right in every respect before it was hardened.

If we have a tool made of some unknown tool steel to harden, the safest way to proceed is to cut a small piece of steel from the bar from which the tool was made, notch it with a hacksaw and harden, then break off at the notch and observe the fracture. If the piece is file-hard and the structure smooth, we are safe to go ahead and harden the tool at the same heat at which the small piece was hardened.

Why Dies Will Sink When In Use

It sometimes happens that an embossing die, although hard, will sink after it has run a few hours and will not stand up to the work for which it is intended. The reason is that the penetration of hardness was not deep enough to support the embossed or working part of the die. This fault can be overcome by heating the die to a slightly higher heat before it is quenched.

What Is Meant by Pack Hardening

When a die, or other object, is pack hardened, it is packed in a box with some suitable carburizing material after which the box is sealed with fire clay and slowly heated up to about 1,470 deg. F. After the heat has *thoroughly* soaked through, the die is quenched in oil to prevent distortion and is then tempered.

Machine steel that is to be hardened is first carburized by being packed in a box of material such as charred leather, charcoal or ground bone, the box luted with fire clay and the work heated to 1,600 deg. F. for from six to twelve hours or more, according to the size of the piece and the required depth of hardness. After the piece has been carburized, the box is taken out of the furnace and allowed to cool of its own accord. The piece is then removed from the carburizing material, heated in a lead pot or furnace to 1,430 deg. F. and quenched in water or brine and tempered to 375 deg. Fahrenheit.

Cyanide Hardening

Another way to harden machine steel is to heat the piece in a cyanide bath to, say, 1,430 deg. F. and quench in water. This gives a very light case on the outside with little or no depth of penetration, but answers the purpose for some jobs.

Cyanide is also used for hardening delicate or small tool-steel pieces to prevent cracking or warping and is done by heating the work in a cyanide bath, lead pot or furnace and smearing the heated pieces with cyanide before quenching in oil. The oil acts as a preventive to warping or cracking, while the cyanide gives the work a hard case.

Tempering

After a tool is hardened it is tempered to relieve the hardening strains and to make it tough and less brittle. The tempering is done by heating the tool in an electric tempering furnace, salt bath, or an oil tempering bath having a thermometer, which registers the temperature of the oil.

If a tool is to be file-hard, it is tempered from 325 deg. F. to not over 350 deg. F. for one-half hour at least, to relieve the internal strains. If the piece is large, it should be held in the oil from one to two hours or more, according to its size.

If the tool is a cutting tool, such as a blanking die, it is usually drawn from 410 to 420 deg. F. Blanking punches are drawn anywhere from 420 to 600 deg. F., depending upon the size and shape of the punch and the kind of metal it is to cut.

A hardened tool made from a low-carbon steel will be softer after tempering at, say, 425 deg. F. than a similar tool made of high-carbon steel and tempered at 425 degrees.

A good rule to follow when hardening and tempering tools is to find out what work the tool has to do and then harden and temper the tool to suit the work it has to perform.

What Is Meant by Centigrade and Fahrenheit

The two temperature scales, Centigrade (C.) and Fahrenheit (F.), are the most commonly used. In the Centigrade scale the freezing temperature of water is called 0 deg. and the boiling point 100 deg., while in the Fahrenheit scale the freezing point is 32 deg. and the boiling point 212 deg. Therefore 100 divisions ($100 - 0 = 100$) on the Centigrade scale are equal to 180 divisions ($212 - 32 = 180$) on the Fahrenheit scale, or one Centigrade degree is $\frac{9}{5}$ ($180 \div 100$) of a Fahrenheit degree. The following formulas, based on the relation just given, make the conversion from one scale to another a very simple process. We will assume that a tool is to be hardened at 760 deg. C. This means that the tool is to be heated to 1,400 deg. F., preparatory to quenching. The rule for converting from Centigrade to Fahrenheit is as follows:

$$\frac{C \times 9}{5} + 32 = F.$$

Example: $760 \text{ deg. C.} \times 9 = 6{,}840$
$6{,}840 \div 5 = 1{,}368$
$1{,}368 + 32 = 1{,}400 \text{ deg. F.}$

The formula for finding the degrees Centigrade is just the reverse and is $\frac{(F - 32)5}{9} = C.$

Example: $1{,}400 \text{ deg. F.} - 32 = 1{,}368$
$1{,}368 \times 5 = 6{,}840$
$6{,}840 \div 9 = 760 \text{ deg. C.}$

Automotive Production

Keeping Track of Quality

By A. H. Frauenthal
Chief Inspector, Chandler Motor Car Co.

The functions of the inspection department—Type of inspectors desirable—Standardization of inspection — Typical inspection fixtures—Hardness testing and its importance—X-raying castings

IN GENERAL the cost of inspection occupies so prominent a position in the total cost of producing any manufactured articles that perhaps some investigation is warranted as to the manner in which the money is spent. An investigation of this nature often results in improved conditions and the attainment of more real value from the investment.

Without going into detail, there are three things desired from the inspection department:

First, protection against incorrect parts getting into the hands of the assemblers with the consequent lowering of the quality of the ultimate product.

Second, protection against the acceptance from vendors of materials of inferior quality.

Third, protection against the scrapping of valuable material due to incorrect fabrication.

A consideration of purchasing conditions is of value in determining the functioning of the inspection department in obtaining these results. Among the other printed matter on the purchase order, there is one idea almost universally expressed. That idea is to the effect that all material is purchased subject to the inspection and rejection of the purchaser. A strict interpretation of this idea would be that any material which in the judgment of the inspection department is not acceptable would be absolutely rejected and it would then be up to the vendor to prove to the inspection department that the material is acceptable. A similar condition should prevail in regard to material manufactured within the shop, that is, in case of rejection it should be up to the person in charge of that particular manufacturing to prove the quality of the material.

This idea, however, is not followed out. The burden of proof in case of controversy is almost universally thrown on the inspection department and it seems to be the general tendency for the other side to expend its efforts in criticizing the inspector's method of proof. This is a distinct hardship. The man upon whom rests the burden of proof is working under a heavy handicap.

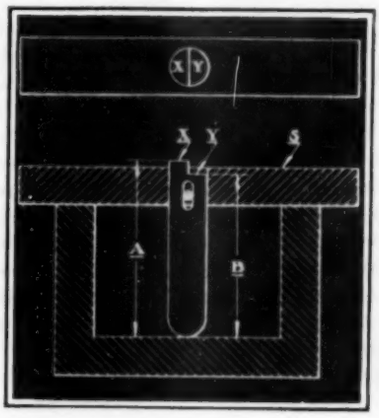


Fig. 1—Simple flush-pin gage

What is the result of all this? It simply means that the inspection department must lick every man at his own game. The forge man comes in to argue about forgings, the foundry man about castings, the machine man about machining and a myriad of other men about a myriad of other subjects. Each of these men spends the greater part of his time on one subject. Perhaps he has spent the greater part of his life on this one subject. He is a specialist in one line. Now, how can the head of the inspection department or one or two of his assistants be sufficiently well versed in all these lines to meet these specialists on an equal footing? It is quite evident that this is impossible.

A comparatively short time ago the usual inspection department was composed of men with sufficient ability to read blue prints, use simple measuring tools, who had a mediocre knowledge of manufacturing processes and reasonably good judgment.

The head of the department had the same qualifications, although perhaps developed to a higher degree, and in addition possessed the ordinary managerial qualifications equivalent to the general run of foremen or department heads. Higher inspection calibre was probably not required. Precision standards of today are far more exacting and the instruments for precision measurements are of a more involved and finer nature. Also the inspection department's scope was generally limited. In some cases only a small portion of the plant's activities came within its range.

At the present time practically every operation in the modern plant is under some kind of inspection control and in some of the larger plants even such commodities as coal, oil and like materials are tested for quality.

At the present time inspectors must be specialists. The deciding factor in determining whether or not to specialize in any branch of work is the ratio of the

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complexity of the work to the calibre of the workers. Some may hold to the idea that inspection is merely the interpretation of specifications and the ability to use the necessary tools and gages to check material to these specifications. This idea, however, is mainly held by those unacquainted with the intimate details and problems of inspection. In some cases it is also necessary to be well informed on a subject before specifications referring to this particular subject can be properly interpreted. It seems to be the consensus of opinion among inspection executives that the only successful method is to train each man for his particular job and

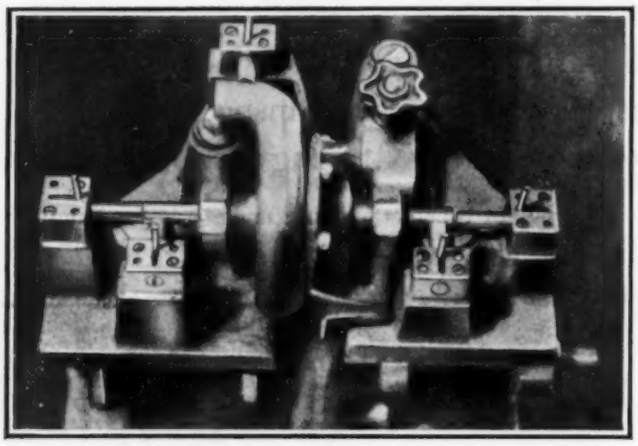

Fig. 2—Flush-pin gage for multiple inspection

then keep him on that job. The question may still arise as to whether or not there are no good all-around inspectors and the answer is that when a man gets to the point where he can do a reasonably good job of inspecting a wide variety of material, he is no longer of the ordinary inspection rank and file. He gets a better job.

If it is advisable to specialize the work of the individual inspector, it is also advisable to specialize the work of the sub-foremen. To accomplish this, the department should be sub-divided into as many divisions as is consistent with its size. The optimum condition is, of course, at the point of greatest specialization or where each sub-foreman has the narrowest branch possible to direct. This is another case of the advantage of a large business over a small one; the large department requires more supervisors, each of whose range is more limited.

The sub-foreman in charge of each of these divisions should be a specialist in that division. It is also becoming more and more important each day that these division heads have a certain amount of technical training or at least such technical tendencies as to be able to grasp, follow and develop the technical side of their work. This necessity has arisen because most of the present-day developments in methods and materials are brought about through systematic research by scientifically minded and technically trained men. These developments, therefore, follow technical and scientific lines and to be in a proper position to determine the qualities of these materials and processes it is necessary for the inspector to have a certain amount of technical understanding.

The head of a department of this type must of necessity bear different qualifications than demanded some years ago. His main ability must be managerial coupled with good mechanical judgment and he must be capable of understanding the technical as well as the practical side of his work. It is not my intention to give the impression that a man must be a college graduate in engineering to hold such a job. I merely desire to stress the point that he should be willing and anxious to follow the technical trend and should be fully able to grasp at least the fundamental engineering principles involved.

A number of the items of everyday inspection are of a far more involved nature than is generally suspected. Hardness testing may be quoted as an example. This inspection operation is constantly practiced in almost every metal working shop in the world. Nevertheless a number of factory executives do not look upon it as a very important item of manufacturing, nor do they feel that it requires any great knowledge or skill to be proficient in hardness testing.

A number of people think of hardness in terms of brittleness and vice versa. In other words, if a piece is particularly hard, it must of necessity be brittle; if it is ductile, it must be soft. This is not by any means the case as different steels with the same hardness show decidedly different properties of ductility.

Machine shop men are sometimes inclined to think of hardness in terms of machinability. Machinability, however, depends on a great many other factors than hardness alone and it has been demonstrated many times that hard material is often easier to machine than softer materials.

To give some idea of the broadness of the subject of hardness, the American Society for Steel Treating recently published a bibliography of hardness testing which is composed of 240 treatises on this subject alone. It stands to reason that if this subject is sufficiently complex or profound to furnish sufficient material for 240 treatises wth the ultimate goal not yet reached, its application to routine work deserves some study by men who are capable of doing more than squeeze a scleroscope bulb or pump up a Brinell machine.

Use of the X-ray

It was previously stated that a great deal of development is in the hands of scientists and technical men and an example of this is worth considering.

The X-ray is often regarded as being valuable only through its use by the medical profession. In the light of this conception it might sound somewhat unique to prophesy that within a reasonably short time, the X-ray will be a common and valuable implement for use in controlling the quality of castings.

A few weeks ago in Boston at the annual convention of the American Society for Steel Treating a paper was read by Dr. Lester of the Watertown Arsenal on "Foundry Control by X-Ray."

We all know that the usual run of steel castings are, to say the least, exceedingly variable in regard to inner structure, usually containing comparatively large and frequent non-metallic segregations, cracks, shrink and blow holes. As it is generally impossible to discover these defects without machining or destroying the casting the X-ray is being used to determine whether or not the structure is solid without this destruction.

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X-rays tend to penetrate almost all substances but the rate of penetration through holes or non-metallic segregations is much more rapid than through metal and this results in any of these defects leaving a spot on the radiograph.

The continued exposure of the operator to X-rays would in time prove fatal. Therefore, the room containing the apparatus is entirely enclosed with lead since lead is the substance most resistant to penetration of X-rays. The tube used for the production of the X-rays is of the highest capacity that is made, utilizing a current of 250,000 volts pressure. The effect of the X-rays is further stepped-up by the use of fluorescent screens. By this method it is possible to penetrate 3 in. of cast steel and obtain a radiograph in 15 min. It is only practical at the present time to picture through 3 in. of steel as the exposure time increases greatly for any thickness beyond this point. In fact, it requires about seven and a half hours to obtain a radiograph through 4-in. steel.

How Experience Was Obtained

The necessary technique was developed by radiographing hundreds of castings over a period of about two years and cutting up each casting to check actual conditions against the appearance of the radiograph. Through this experience it is now possible to describe the interior of the casting without cutting it in any way.

This method of checking quality led to considerable improvement in foundry workmanship as each defect as found was properly followed up and the necessary revisions made in the foundry practice to correct it.

The story of how one defect was corrected illustrates the desirability of technical training. It is quite usual to find pockets of gas that have been entrapped in the metal during freezing and it is also quite usual to find sand holes. In one case, however, some castings were tested that showed evidence of containing gas pockets due to the spherical shape of the spots on the radiograph. When the casting was sectioned the gas pocket was found but it also contained a small amount of a black sand-like substance. The walls of the hole were smooth and shiny as is to be expected from a gas pocket, but the black sandy substance could not be explained. The next step was to procure a careful chemical analysis of this material which turned out to be silicon dioxide and carbon. The results of the analysis, however, did not go very far in clearing up the mystery until a very careful survey was made of the foundry practice. It was then found that the molds were not being perfectly cleaned of sand with the result that some of the sand was carried into the casting by the metal. This accounted for the presence of the silicon dioxide and further investigation determined that the foundry was using a molasses binder in the molding sand which accounted for both the carbon and gas as molasses is a carbohydrate and when heated by the molten metal breaks down to its constituent gases and carbon.

In considering the inspection organization the importance of the department office should not be overlooked. It is here that all technical and mechanical data are translated into English that can be read with equal understanding by both the mechanical and non-mechanical. In this respect the inspection department is the connecting link between the shop and the engineering and purchasing departments.

The inspection department office is also the repository of records of all irregularities from usual shop practice and variations from specifications and it is quite necessary that these variations be faithfully and painstakingly recorded for at least two reasons:

First, to furnish a written record in case the same or a similar item is up for disposition at some later date.

Second, to furnish data for investigations of any troubles that occur after the product has been sold.

So far as I have been able to determine by visiting other plants, cost and time analyses of inspection operations have not been gone into, in general, as deeply as they deserve. The problem of inspection operations can be approached with excellent results in the same manner that machining and assembly operations are approached and in a great many cases such palpable improvements have been made that it is my firm belief that arrangements should be made so that a man well versed in inspection and time study could devote a large part of his time to this work.

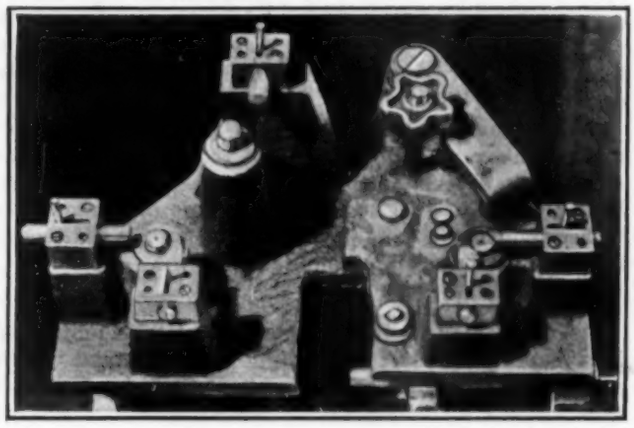

Fig. 3—Gage shown in Fig. 2 empty

A man working piece work or a time-study man gives a great deal of attention to elimination of small moves and the doubling up of operations, that is, doing the greatest amount of work with the least number of moves. The same idea should be applied to inspection methods and the same results in economy of time will be gained.

In inspecting parts requiring the observation of more than one item or dimension, the gaging method often requires the use of a number of individual gages. When this is the case, it generally follows that a number of moves, each involving a certain amount of time, are required merely for picking up and laying down the gages and parts.

To demonstrate the high cost of these moves we made a comparative time-study involving two different methods of scleroscoping cam rollers, one of which eliminates some very short moves. In one method the scleroscope hammer is operated by a hand-bulb, in the other by a foot pedal. The approximate dimensions of these cam rollers are O. D. 1 in.; I. D. $\frac{1}{2}$ in.; thickness $\frac{3}{8}$ in.; and they are hardened and ground all over. To permit

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of the roller being scleroscoped in four places on the periphery, it is necessary for the operator to rotate the roller through approximately 90 deg. three different times. When using the bulb method, the left hand operates the clamp, while the right hand operates the bulb and also rotates the piece. The right hand constantly grasps the bulb but the operator cannot squeeze it while his hand is in the cramped position necessary for turning the roller. A movement of approximately 2 in. is, therefore, required to get the hand into a suitable position for squeezing the bulb and takes place three times with each roller.

With the foot-pedal method these extra movements are avoided, since both hands are free to manipulate the specimen and the clamp. We found that an experienced operator requires 7.8 sec. per piece by the hand-bulb method and 6.0 sec. by the foot-pedal method. We, therefore, show a saving of a little more than 23 per cent of the original cost.

The economy gained by avoiding these slighter movements makes it highly desirable to attack the larger movements associated mainly with the picking up and laying down of gages and parts. This can frequently be accomplished by the use of multiple gages that check several different points simultaneously.

Weakness of Solid Gages

Gages of this type, however, are practicable only when they have been carefully designed and adapted to the part involved. Solid "Go" and "not-Go" gages of this type are not a commercial success except when a large majority of the parts are correct. Their weakness lies in the fact that they do not indicate the exact defect in the part. The only information gained is that the part is not correct, since it does not fit the gage, and the inspector must then recheck it to determine which dimension is at fault. The inflexibility of this type of gage is particularly embarrassing when it is desirable to salvage a quantity of material containing a universal defect, provided all the other dimensions are correct. The fact that one dimension is at fault makes it impossible to inspect the part farther.

The difficulty may be overcome by replacing the rigid gaging points with indicators of one type or another, but if the tolerances are small, requiring dial or compound lever-type indicators, the result is often a gage that will be too delicate for ordinary use. Gages of this type should be reserved for small light parts and careful inspectors.

When the tolerance is more than plus or minus 0.003 in., the flush-type indicator or "flush-button" gage has proven very satisfactory. This gage as shown in Fig. 1 consists merely of a sturdy pin with a tolerance step ground on the end and is used in connection with a ground surface on the piece within which the pin moves at right angles. The distance *A* corresponds to the low limit and the distance *B* to the high limit. When the part being checked is on the low limit, the *X* side of the pin is flush with the ground surface *S*; when it is on the high limit, the *Y* side of the pin is flush.

The limitations of the gage, therefore, depend upon the ability of the inspector to determine when the surfaces are flush or not. We have found that by running the finger across the end 0.001 in. above or below flush can be easily felt if the corners are sharp. By virtue of this fact we are provided with a gage of low initial cost that embodies sturdiness, durability, ease of replacement and simplicity of operation. It can be used for all calculations by any one having the sense of touch, and sight readings are eliminated.

Indicators of this type can be used in a great many places on large inspection fixtures and will permit the inspection of a great many items on a single inspection operation. Fig. 2 shows such a fixture with a water pump, for which it was designed, in place. Ten different dimensions are simultaneously checked and a notable feature is the fact that any of the dimensions can be off considerably more than commercial probabilities and still be completely checked. Fig. 3 shows the same fixture without the water pump and the ten gages can be seen.

An example of multiple gaging in automotive work

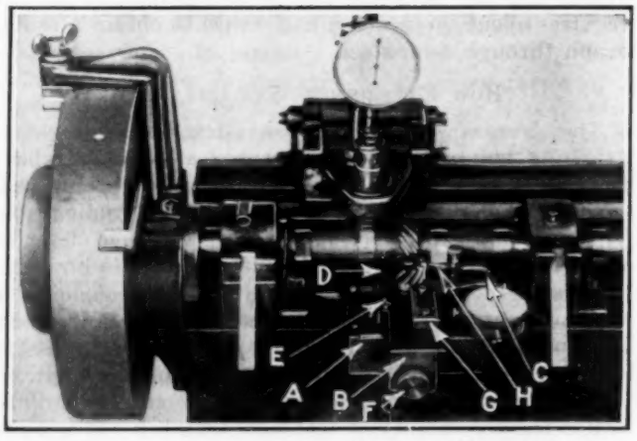

Fig. 4—Camshaft inspection fixture with provision for checking spiral gear

is an item of camshaft inspection. Many present-day engines have the oil pump gear integral with the cam shaft. This design lends itself admirably to multiple inspection, as a very complete gear-checking fixture is readily applied to the conventional camshaft-checking fixture. The fixture shown in Fig. 4 is used for checking the spiral gear on the camshaft and its mating gear on the oil-pump, as well as for ordinary camshaft inspection. When camshaft gears are checked a master oil-pump gear is used on the fixture, and when oil-pump gears ars checked a camshaft containing a master gear is used.

The casting *A* is rigidly fastened to the bed of the camshaft fixture. Casting *B* which bears the oil-pump gear, is dovetailed into *A*, is free to move toward or away from the cam shaft and is held toward the camshaft by the spring *D*. The slide *B* and hence the oil-pump gear, can be maintained at any desired distance from the camshaft gear by turning the thumbscrew *F*. At *E* is a vernier that allows any desired center-distance to be set and indicates the amount of backlash in terms of center-distance when the gears are in metal-to-metal contact. To check concentricity, the gears are held tightly together by the spring *F* and when the gears are revolved, a forward and backward movement equivalent to twice the eccentricity is induced in the slide *B*. The part *G* is fastened to *B* and transmits to the lower indicator the motion induced in *B*.

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The part *G* also contains a feature for showing actual backlash on the lower indicator, after the slide *B* has been set to any desired center-distance by the thumbscrew *F* and the vernier *E*. At *C* is a hole in *G* in which is a short pin that is either free to move in the hole or can be held rigid by the small thumbscrew shown behind the indicator. The indicator operates against the end of this pin and when checking eccentricity, the pin is held rigid. However, when actual backlash is desired the slide *B* is held rigid and the small pin is free to move; one end of the lever *H* is brought into contact with a gear tooth; the other end, with the movable pin. Thus, when the pinion is moved through the backlash the motion of the gear tooth is transmitted to the indicator.

The doubling-up of inspection in this manner cuts down initial gage-cost and makes unnecessary a separate operation. An idea of the amount of labor saved can be gained by comparing the magnitude of the movements eliminated in these cases with the magnitude of the movements eliminated in the example of scleroscoping.

The Psychology of Inspectors

Another item that should receive some attention is the psychology of inspectors. It particularly deserves some attention when designing gages. It is true that considerable success has been obtained in the elimination of incorrect inspections by studiously making each gage so simple of operation that it can be used by the inspector of least brain power. This system, however, has its drawbacks mainly because it is often costly. Frequently a small amount of inexpensive brain work can be used to replace costly equipment. Since it is usually the case that different classes of inspectors are used on different classes of work a consideration of the workings of the minds of inspectors in particular branches of work can be used in designing gages suitable for this type of mind and will materially decrease gage cost.

A number of large shops and some smaller shops have standardized their inspections, that is, they have permanent specifications to inspect a certain percentage of certain parts or to inspect a certain percentage of certain dimensions on a particular part. These standards are generally worked out according to the necessary qualifications for the part and the type of machinery or workmanship producing it. Such standardizations can, undoubtedly, be of considerable value in cost control. However, it is my opinion that standardization of inspection is a disadvantage except in special cases because it is usually necessary to give more inspection for a given amount of protection than is necessary by the method described below:

The fallacy of standardization of inspection lies in the fact that it presupposes the inspector to be informed as to which items will be defective. It is quite true that it is of value to be constantly in suspicion of the quality to be derived from certain operations, but it is also true that things go wrong with operations in which we have the most confidence. For that reason the writer has always supported the method of carefully selecting samples of lots or shipments and inspecting these samples to the minutest detail. This selection must be done with the idea of obtaining representative samples so as to gain an idea of the general quality of the lot or shipment. From the report of these samples the inspection procedure for the particular lot can be fairly well determined.

In the inspection of materials received from outside sources one of the greatest aids is the inspector's knowledge of the general quality of the work received from that particular source.

Some companies have very good reputations in inspection departments. Others have not. It is a logical procedure to inspect the work from a poor source more carefully than material received from good sources.

Abstracts

from other publications

Milling Mack Trucks Connecting Rods

The tooling equipment designed by the Cincinnati Milling Machine Co. for performing the milling operations on Mack truck connecting rods is described in this article. These rods are steel drop-forgings machined all over and a diagram shows the places where material is removed. In the roughing operation, four form cutters with but a single ring of teeth are mounted on the two arbors for hogging out the metal between the bolt lugs on the top and bottom sides of the rods. Owing to the fact that these lugs are forged solid, considerable metal must be removed, and as the metal is tough, the operation is considered a severe test of the machine. The average time per piece in this operation is 1.42 minutes, using a 4½ in. cutter at a speed of 53 revolutions per min. and a feed of 3½ in. per minute.—*Machinery*, December, p. 276.

Maintaining a Smooth Production

E. F. Roberts, vice-president of manufacturing of the Packard Motor Car Co. lays down the following principles. First, a manufacturer should have on hand exactly enough raw and semi-finished materials, second, each process should be carried out promptly and satisfactorily; third, material should be moved promptly from process to process. The article describes how this is done in his company. Mr. Roberts states that in working out the present system of controlling production, it has been found that they can deal with the problems of investment and time just as definitely and just as successfully as they handle cost of materials and labor.

With his schedule-control system, stocks of raw material and inventory of semi-finished goods are kept to the proper level and automobiles are manufactured at the rate of speed which gives proper results in quality and economy. It also aids in governing the time element in time production cost.

Exactly enough raw materials for the needs of the immediate future are in hand. The longest period of time work is scheduled is 120 days. This is the time that normally elapses between the ordering of green

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lumber for car bodies and the shipment of the cars in which lumber is used. Eighty-four days ahead of the shipment date, placing of orders for material needed in the chassis must be completed. Seventy-two days ahead, purchases of chassis materials must be completed and 63 days ahead, dry lumber, sheet steel and aluminum for bodies must be on hand. Altogether 30 different stages in "upset dates" are arranged. Once a month the manufacture of a certain number of cars is authorized in accordance with the 120-day program, the number of cars depending upon market conditions.

A photograph of the control board, which is the keynote of the system to save delay is given and a description of the working out of the control.—*Factory*, December, p. 794.

Heat Treatment of Automobile Parts

J. M. Watson, metallurgical engineer of the Hupp Motor Car Corporation describes the method and equipment used in his plant in connection with the new heat treatment department installed about a year ago. The equipment is automatic as far as possible and furnace designs were worked out for each specific case. One furnace, for example, is used exclusively for normalizing forgings and annealing cast iron parts. It is equipped with a continuous pan conveyor, the pans being made of a special heat resisting alloy. The pans hook together and are grooved at the bottom to fit skid bars on the hearth of the furnace. They are pushed through and at the discharge end the parts drop out of the pans into trucks and are carried to a hardening furnace similar in construction but discharging into a bath of quenching oil, whence the parts are picked up by a pan conveyor and carried to a drawing furnace. Another furnace hardens the front axle, the forgings being carried through on a moving hearth which has a forward stroke of 6 inches. The process is continuous and when the forgings reach the discharge end of the furnace they drop onto a pair of counterbalanced fingers which carry them into the oil in a level position. They are then deposited on a chain conveyor which synchronizes with the hardening unit and are picked out of the oil and conveyed to the draw furnace of the unit. At the discharge end of this furnace the axles are dropped onto trucks. Several photographs illustrate the process.—*Transactions of the American Society for Steel Treating*. December, p. 716.

Heat Treating Oakland Axle Shafts

The heat treating unit which is illustrated and described was designed for the single purpose of heating, quenching and drawing axle shafts. The unit operates in the machine line, with comparatively unskilled labor; it has low operating and maintenance costs, takes up comparatively small floor space and turns out a uniform product. The shafts are roughed machined to remove all the excess material while in a soft state. They are then heat treated to 302-340 Brinell, straightened and finished in machines. One man straightens 70 to 100 shafts an hour. In the furnace one experienced operator heat treats 60 shafts an hour and each shaft is one hour in the furnace. The shafts are handled with air operated tongs attached to a quick-acting air hoist and the furnace doors themselves are air-operated by a foot lever. The hearth of the furnace rotates on a race of 1-in. steel balls. When a switch button is pressed the hearth moves 2½ in. and then stops automatically. This movement brings an empty holder in line with the charging opening and a hot shaft ready for quenching in line with the discharge opening. Water at 180 deg. F. is used for quenching. The temperature is controlled automatically by Leeds & Northrup instruments.—*Fuels and Furnaces*, December, p. 1241.

The Automobile Industry And the Machine Tool Builder

In answer to the question, "What is the machine tool builder's greatest opportunity for effective service in the automotive industry at the present time?" many machine tool builders have suggested that each manufacturer should make a more precise study of the production possibilities of his particular type of machine under the conditions existing in automobile plants when the machine is installed as a unit in a complete production line. The need for better co-operation between the two industries is emphasized and it is also recommended that engineers in the automobile factories should visit the machine tool builder's plant and observe the latest developments that would apply to the automobile manufacturing requirements. Another answer states that the greatest difficulty facing the tool builder is the greatly varying practice of different automobile manufacturers and that one of the greatest services the machine tool industry can render is to aid in determining the best method for each kind of work and in standardizing upon it. Machine tools in automobile plants are subjected to very severe service. In many instances they run twenty-four hours a day and when production is at its height the pressure on the maintenance department is so great that proper care is not given to the machines. Further, inexperienced operators often employed know very little about the care of machine tools, so it is necessary to design the equipment so simply that little or no experience is required in its operation.

Many machine tool builders believe that the automobile industry as a whole is paying too little attention to the training of mechanics for the future. Very few plants have anything resembling a systematized apprenticeship, and where training shops are to be found, their object is mainly to provide men with sufficient knowledge to become operators rather than all-around mechanics. The tool industry has to bear a large portion of the burden of training mechanics, and from their ranks are recruited the shop executives and skilled mechanics for the automobile plant.

On the question of single purpose versus standard machines, one well known builder of drilling machines believes that the automobile manufacturer is leaning toward single-function machines rather than single-purpose machines. This appears to be the logical step due to the fact that the automobile is not as yet standardized to such an extent as to warrant the building of wholly single-purpose machines. However, another authority believes that the tendency is toward single purpose machines.—*Machinery*, December, p. 263.

Calculator for Horsepower of Spur Gearing

By Robert Johnson
Manchester, England

Design and operation of a convenient calculator for use in gearing problems—Practical examples of the use of the device—Horsepower factors

ALTHOUGH many formulas and much data are in existence on the subject of the determination of the horsepower of gearing, the writer is not aware of any ready and easy method that will enable the designer or buyer to tell quickly the relation between the governing factors of the problem. These factors include the value of the power transmitted, the velocity suitable for the nature of the drive, and the type of gearing the most economical to install, while giving a reasonable life and factor of safety.

For the purpose of giving a quick method of solution for such problems, I designed, some four years ago, a circular calculator. The calculator is shown in the accompanying illustrations, from which it will be noted that the parts of the device carry logarithmic scales of the principal factors that influence the determination of suitable gearing, both in size and type, for a given unit. The apparatus has three parts and these are pictured separately in Figs. 1 and 2. For use in the solution of problems the parts are fastened to-

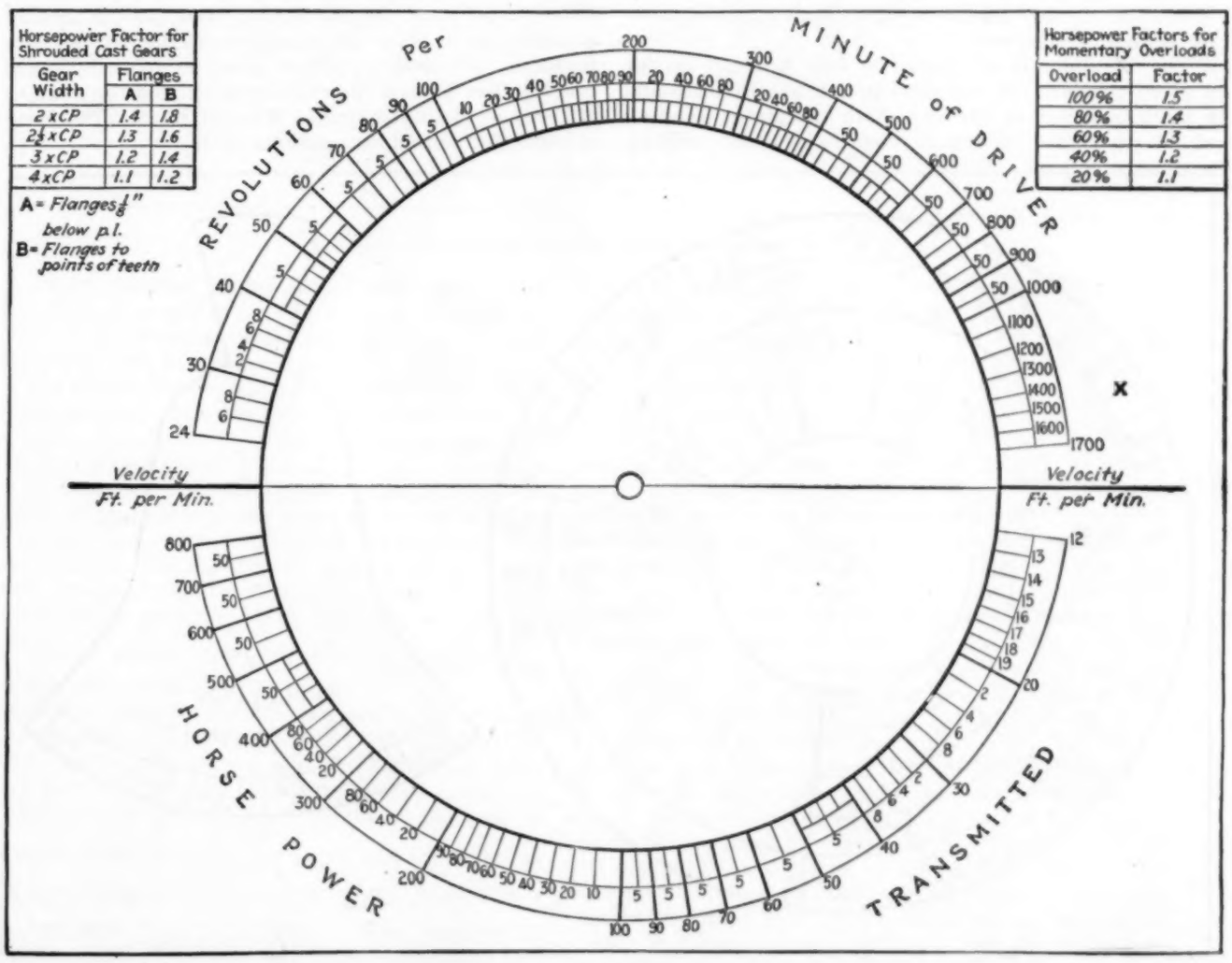

Fig. 1—Base section of gear calculator

gether in such a way that they will turn in relation to each other about a common center.

The base *X*, Fig. 1, is fixed and its upper scale registers the r.p.m. of the driving pinion. A scale of horsepower values is located on the lower half. The circular disk *Y*, Fig. 2, revolves on *X*, its top scale indicating the diameter of the driving pinion in inches. Immediately below the top scale is a scale of pitches, both diametral and circular. The lower portion of the disk has a scale of pitch line velocities in ft. per min., together with certain factors that affect the results of the computation. The use of these factors will be explained later in the article. The scale on the lower arc of the section *Z* indicates the width of the pinion in inches. The pointer at the top has two radial edges, one edge being used for steel and one for cast iron, respectively.

If it is desired to find the pitch-line velocity in ft. per min., the diameter of the driving pinion *Y* is placed opposite the r.p.m. on the base *X*, and the velocity can be read from *Y* opposite the horizontal center line of *X*. With the calculator set in this way the horsepower that can be transmitted is determined by placing the proper edge of the pointer on *Z* opposite the given pitch on *Y*. The horsepower can then be read from the lower scale of the base *X* opposite the width of the wheel on the lower scale of the portion *Z*. The diameter of the driven wheel can also be read from the upper scale of the disk *Y* opposite the r.p.m. at which it is to run. This latter is only meant to be a rough approximation for designing purposes.

The calculator is illustrated in Fig. 3 as set up for a given problem. A cast-steel pinion has 19 teeth and a pitch diameter of 18⅛ in. With the pinion running at 200 r.p.m., the velocity is found to be about 1,000 ft. per min. The circular pitch is 3 and the pinion is 10 in. wide so by manipulating the calculator as explained above, the horsepower transmitted is found to be 435 hp. If the driven wheel is to run at 50 r.p.m., the device shows that its pitch diameter must be 72½ inches.

In order to make the calculator as universal as possible, the horsepower reading is arranged to be a general and nominal one only. By the use of the factors on the disk *Y* and a little mental interpolation, the true horsepower corrected for velocity, type and accuracy can be determined for four types of gears.

Continuing the example, the class of gear is not yet specified. The velocity scale registers approximately 1,000 ft. per min. and many types can be installed to give efficient service at this velocity. Using the factors indicated, the corrected values for the horsepower for the different types will be found as follows:

Type A—Machine-molded straight teeth

$$0.75 \times 435 = 326 \text{ hp.}$$

Type B—Machine-molded double helical teeth

$$0.85 \times 435 = 370 \text{ hp.}$$

Type C—Machine-cut straight teeth

$$1.0 \times 435 = 435 \text{ hp.}$$

Type D—Machine-cut double helical teeth (continuous or staggered)

$$1.2 \times 435 = 522 \text{ hp.}$$

The factors for the machine molded straight teeth are for efficient working at pitch-line velocities up to 1,000 ft. per min., and for higher velocities the factors are reduced to allow for excessive friction of the cast surfaces. The width of these gears is generally made equal to 2 or 3 times the circular pitch, and the number of teeth in the pinion varies from 17 to 23. The ratio of reduction should not exceed 4 to 1.

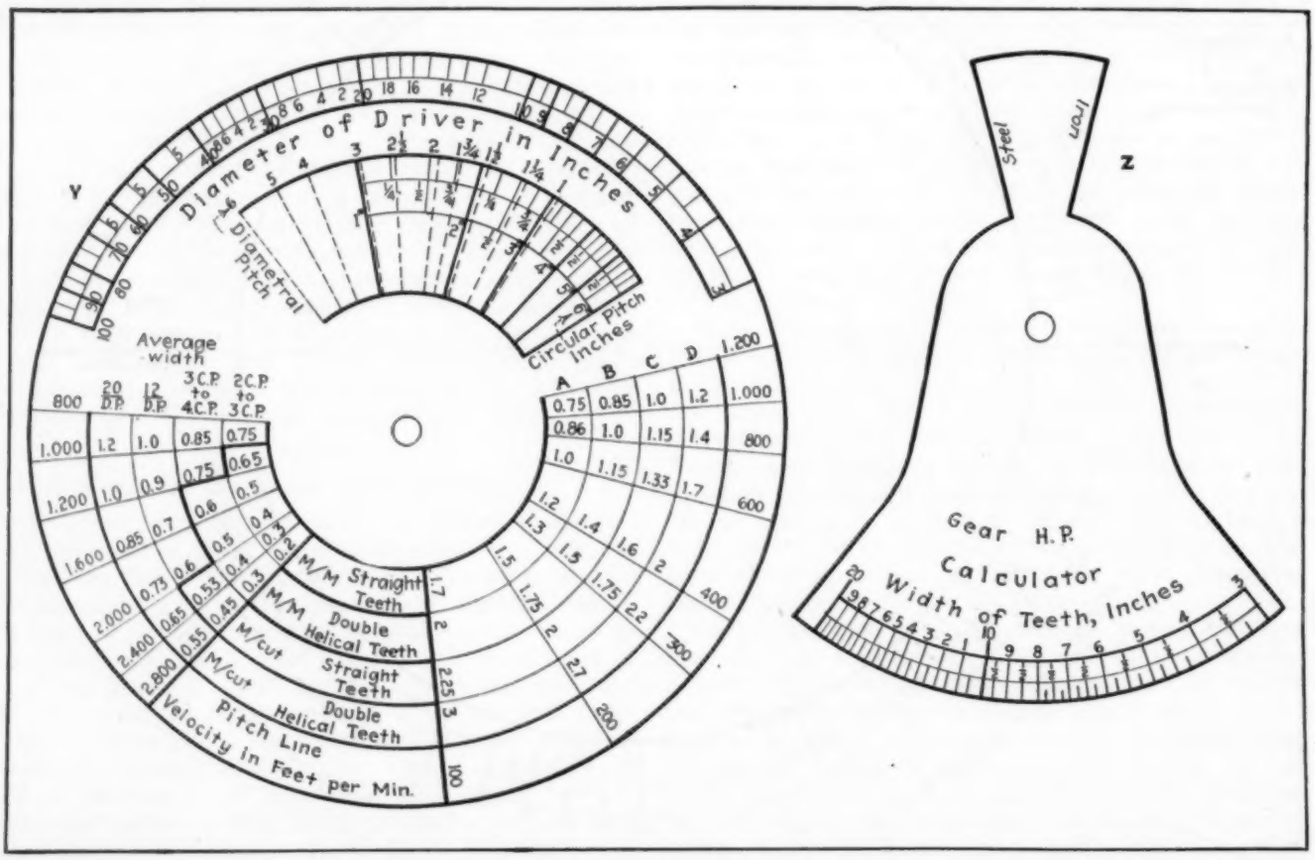

Fig. 2—Other sections of calculator

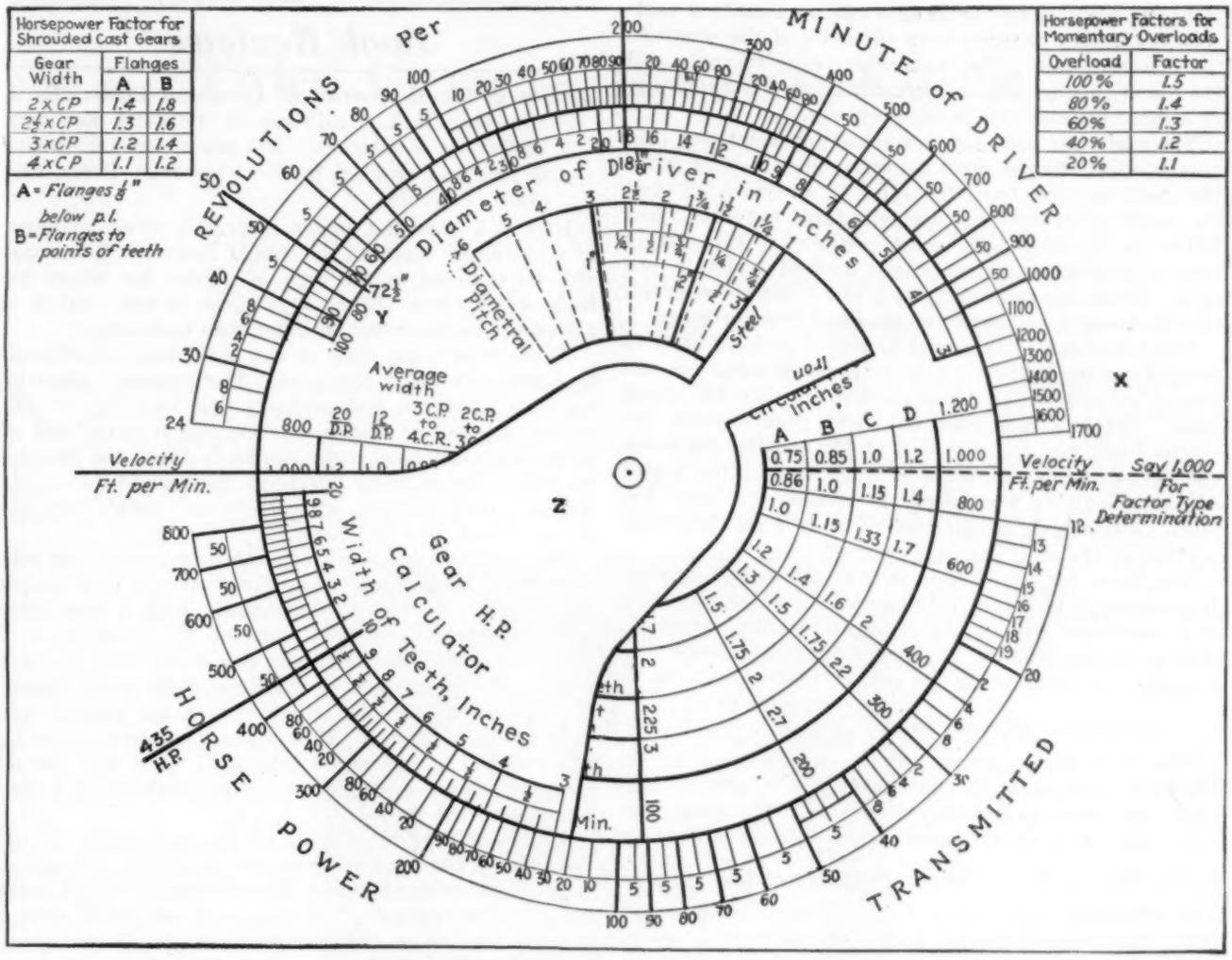

Fig. 3—Calculator set for a given problem

For machine-molded double helical teeth the factors are for efficient working at velocities up to 1,200 ft. per min. Very large gears are made of this type and the calculator can be used for circular pitches up to 6 in. The width of such gearing is usually from 3 to 4 times the circular pitch and the pinions have from 13 to 19 teeth. The ratio of reduction rarely exceeds 5 to 1 for heavy transmissions.

The factors used for machine-cut straight teeth will give efficient operation of the gears at velocities up to 2,000 ft. per min., with good grease lubrication. For higher velocities the factors are still in direct ratio, but they are only suitable for installations where the gears run in an oil bath. It is desirable to have the width of the pinion equal to about $\frac{12}{\text{diametral pitch}}$ and it may have from 19 to 25 teeth.

The factors given for machine-cut double helical teeth are for pitch-line velocities between 1,000 and 2,800 ft. per min. Below 1,000 ft. per min, the factors are high, to allow for the first-class conditions usually associated with this type of gearing. The width of the gear is often made equal to $\frac{20}{\text{diametral pitch}}$ and it is not, as a rule, economical to install a gear of this type with a width less than $\frac{12}{\text{diametral pitch}}$. The number of teeth in the pinion may vary between 17 and 27.

High-velocity gearing for turbines and similar machines is outside the scope of this article, and its problems are approached in another way. Corrected forms of teeth, variable-center gears, interchangeable units having pinions with few teeth, and other special-purpose gears must also be considered separately. These should all be treated on their own merits.

In the upper right-hand corner of the base section *X*, Fig. 1, there is a table of overload factors by which the rated horsepower of the driving motor may be multiplied to give the horsepower for which the gearing must be designed. These factors are for momentary overloads only. If the overload is liable to continue for a period of more than two minutes, the maximum horsepower delivered by the prime mover must be the basis for the design of the gearing. If, for instance, the 80-hp. motor driving a train of gearing is capable of carrying a 40 per cent overload of a momentary nature, a total equivalent of $80 \times 1.2 = 96$ hp. must be transmitted by the gearing.

In the case of cast gears, the addition of flanges at the sides of the teeth increases their strength considerably. The horsepower already found should, for flanged gears, be increased by the ratios shown in the table in the upper left-hand corner of the base section *X*. The factors in the first column under *A* are for gears with flanges to within ⅛ in. of the pitch line on both sides. Under *B* the factors are for gears that are flanged to the points of the teeth on both sides. It will be observed that the additional horsepower due to the increased

strength supplied by the flanges has been made a variable and that it changes with the ratio of the width to the circular pitch. The factors are easy to apply and the use of this method is suggested as an approximation of a more difficult and involved theory.

The materials used for gears are generally cast iron or cast steel, forged steel being frequently used when the teeth are cut from the solid. Cast steel, as used for gears generally has an elastic limit range of from 30,000 to 36,000 lb. per sq.in., while cast iron rarely has the generally assumed elastic limit of 12,000 lb. per sq.in. Thus, the ratio of 2½ or 3 to 1 holds between the tensile strength properties of steel and iron for gears.

The calculator is arranged to give a ratio of steel to iron of approximately 2.1 to 1, thus allowing for the proper ratio after an equal amount of wear has taken place. Hooke's law does not hold good beyond the elastic limit, nor for cast iron at all, and the following calculation, upon which the arrangement of the scales of the calculator are based, is worked out only for steel. The equivalent for iron is made a constant proportion of the steel values, as stated.

The basis for the design of normal-velocity gearing is generally to be found in the assumption that the tooth is a cantilever with width B, depth D, and length L. Assuming the load to be evenly distributed over the breadth, and designating the velocity in ft. per min. by V,

$$\text{Horsepower transmitted} = \frac{V \times B\ D^2}{33{,}000 \times 6\ L} f.$$

The safe static tensile stress is assumed to be 20,000 lb. per sq.in. for cut gears and 15,000 lb. per sq.in. for machine-molded cast gears. This stress has been reduced with the increase in velocity according to the ratio in the well-known Lewis formulas, $\frac{600}{600\ V}$. The allowable unit stress f thus found, compounded with other considerations forms the factors as given for the four types at the specified velocities. The factors for the straight-tooth gears, both cut and cast, were determined along these lines. The factors for the helical teeth were determined from the consideration of the essential features of such gearing and in relation to the strength of straight tooth gears.

Since in most practical problems, the overload conditions, shocks, and conditions of starting are vague factors from which to assess the peak loads, it is hoped that the calculator will be of sufficient accuracy to justify its use for general transmission work. It is thought to be especially valuable for those who have to specify or use various types of gearing commercially, as distinct from those designers who only have to consider the gear wheel from the standpoint of mechanical efficiency.

Census of Radio Manufacture

The Department of Commerce announces that, according to the data collected at the biennial census of manufacturers, 1923, radio apparatus to the value of $43,460,676 was manufactured during the year for sale as such. This total includes 1,889,614 head sets, valued at $5,352,441; 508,001 loud speakers, valued at $5,620,961; 414,588 receiving sets of the tube type, valued at $12,065,992, and 116,497 receiving sets of the crystal type, values at $550,201, together with the other items. The manufacture of 2,601,575 radio tubes, valued at $4,572,251, was reported separately. This is the first comprehensive radio census.

Book Reviews

Studies in the Economics of Overhead Costs. By J. Maurice Clark, Professor of Political Economy, University of Chicago. 502 pages, 6x9 in. Bound in cloth. Published by the University Press, Chicago. Price $4.

Here is a book that should be read by every manager of a business. Many of the things Professor Clark says will be familiar to the type of reader for whom the book was written but he says them so well that it is a pleasure to encounter old friends in new garb.

There is so much meat in the book that it is difficult to select points for comment. The average industrial manager, however, will probably find food for thought in the chapters on standardization and research and on labor as an overhead cost. Certainly there are fanatics on both sides of these questions that would do well to compare their theories with Professor Clark's calm analyses of the pros and cons.

The author has a trick of analyzing each of his subjects into all the possible subdivisions and then taking the several divisions up individually with a concluding paragraph or section that sums up the situation in a way that makes his arguments and points stick in one's mind. His comparison of the three methods of allocating costs, for example, will be worth the price of the book to some readers. How many managers are using the "method of operator's estimate" when they should be using the accounting or statistical methods, or a combination of the three?

Professor Clark's estimate of the part played by the machine in our modern economic structure will appeal to builders of machinery. His conclusion should make all of us thoughtful. "We may end our study with a curious wonder at the intricacies of the financial-economic machine which man has built. . . . No man has yet comprehended them thoroughly. Yet we do know enough to offer some prospect of controlling them, though we must well-nigh remake ourselves and our industrial organization in the process. And so we may look forward, not without hope to the task of taming the New Leviathan. The stakes are heavy, for if we do not tame him, he may devour us."

Structural Engineering. Strength of Materials. By George Fillmore Swain, Professor of Civil Engineering at Harvard University. Clothboard covers, 569 pages, 6x9 in., illustrated. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $5.

This textbook on the strength of materials is the first of a series of four to be published covering the general subject of structural engineering. The second volume will consider the properties of materials and will be particularly designed to accompany this first volume. The last two of the series will complete the study of the theory and design of simple structures of wood, metal and masonry, together with the consideration of more complicated and statically indeterminate structures.

It is apparent that this series of books will provide a complete treatise on structural engineering and the first volume gives an indication of the value of the work. The material in this book is valuable to other than structural engineers, being practical in arrangement and selection of material.

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Take Care of the Workman

By H. S. Riggs
Advertising Manager, the Lodge & Shipley Machine Tool Co.

Safeguarding health—Work of the General Safety Committee—Lighting—Machine Guards—The Mutual Aid Society—Both employer and workman benefited

NOT SO many years ago the health of the workman was given less attention than, for example, that of the horse. The trend of thought was that the man could talk and if he felt sick he could see a doctor. With the horse it was different. Care was taken to see that it was correctly fed and housed and not overworked. All sorts of precautions were taken merely because the horse, to do the greatest amount of work, needed man's assistance.

Then a few manufacturers tried giving their employees more thought and care. The response was most gratifying and others quickly followed suit. Nowadays, the employer realizes that the better care he takes of his workmen's health the more work they will do.

A healthy workman is a happy man and a happy man is the one who produces the most. After all, the human factor enters into the production end of a business. All sorts of automatic machinery can be used but if the guiding hand is sickly, if the place where the workman must stay every day is poorly ventilated and dimly lighted, he is not going to do the amount of work he would do if these things were properly attended to.

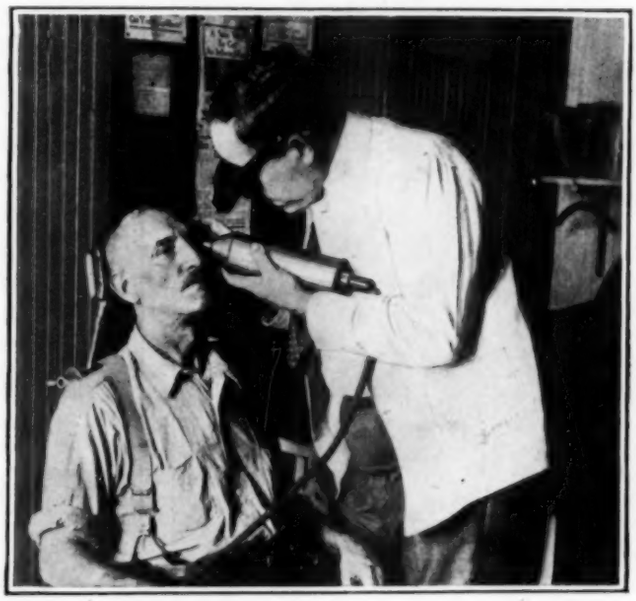


Fig. 1—The plant physician removes steel splinters from the eye by means of an electro-magnet

Hundreds of factories have been transformed by cleaning, installing better lighting systems and watching the workman's health. These transformations cost money, but the dividends far overshadow the costs. Some of the steps taken by the Lodge & Shipley Machine Tool Co., Cincinnati, are described in this article. The improvements were primarily the result of good work on the part of the General Safety Committee.

The General Safety Committee has complete charge of all things that directly concern the welfare of the workman. This committee consists of the Shop Superintendent as chairman, the General Erection Foreman, who takes care of all guards on machines and belts; the Shop Labor Foreman, who oversees all scaffold work, inspects ropes, chains, cranes and fire-fighting equipment; and the Chief Electrician, who looks after the lighting. In addition to the safety committee a plant physician, whose office is located in the shop, aids materially with suggestions and services.

The committee meets regularly. Suggestions for safeguarding the workmen are made and discussed. Any changes or improvements decided upon are put into practice by the committee member who has charge of that particular work. The suggestions do not always originate with the members of the committee but may be given to them by the men in the shop. After all, the men in the shop really are the ones who offer timely suggestions and they usually can be relied upon explicitly.

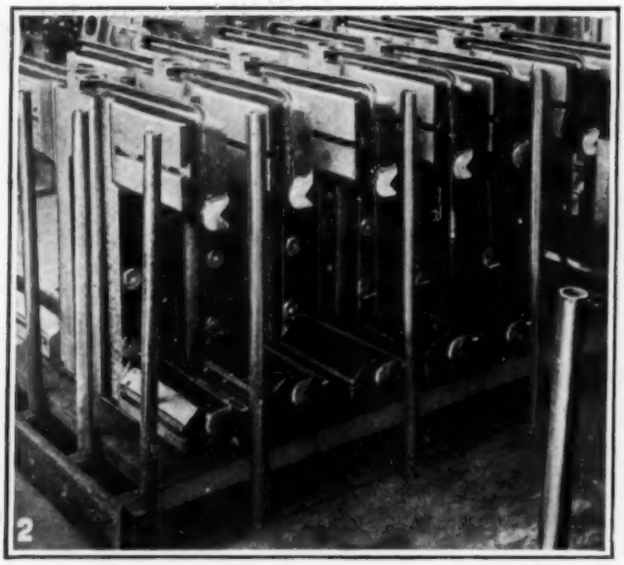
As a result of the committee's work innumerable safety precautions have been made throughout the plant. Precautions must be of real value or out they come. Some of the precautions provided during the last few years are shown in the illustrations.

The average workman appreciates the attention that such a committee pays to his working surroundings. This appreciation may not be shouted from one man to another but gradually it is shown in more and better work. It is human nature to respond to such treatment.

An important factor in keeping the employees at their best is the plant physician. As soon as an employee has been hired he must fill out a report giving the history of his health. This is followed by a physical examination to discover any weaknesses that may interfere with his work.

The plant physician is equipped to take care of any emergency. The old way of sending a patient out to the neighborhood physician, with subsequent visits, never did work out to complete satisfaction. When an illness of a serious nature is discovered the employee is advised to secure the services of his family physician.

Proper ventilation is a necessity when maximum production is expected from each employee and particular



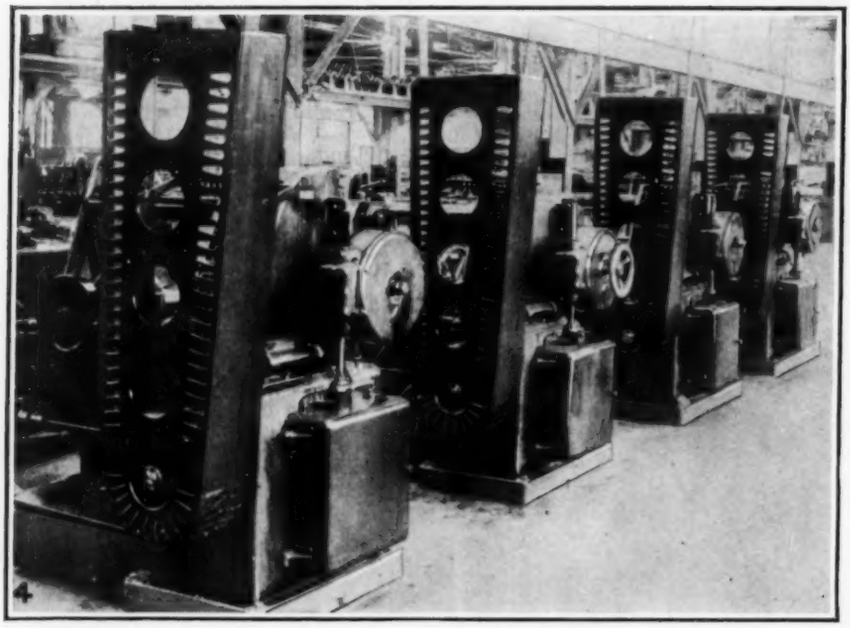


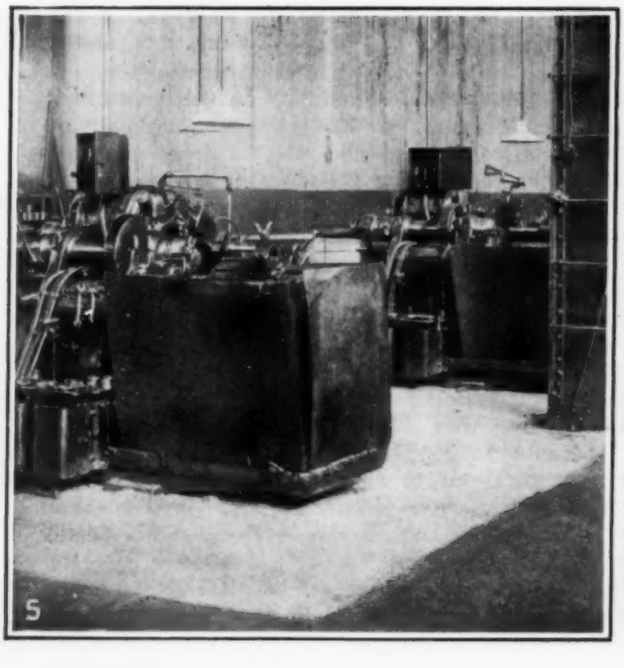
Fig. 2—Carriages, because they can be upset easily, are stacked in racks

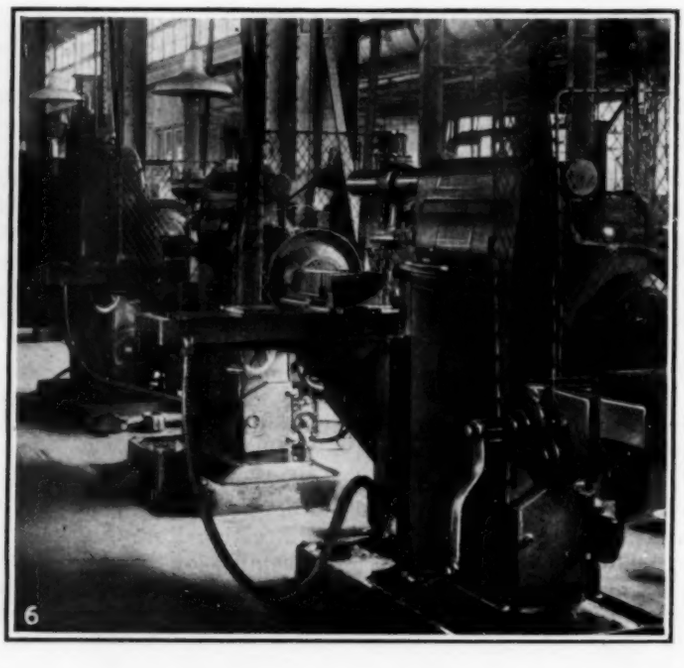
Fig. 3—Danger post, marking extreme overhang of planer table

Fig. 4—Belt guards on a battery of hobbing machines

Fig. 5—Sawdust used to prevent slippery floor around automatics

Fig. 6—Wire guards over belts of milling machines





care is given to it. Forced hot-air and steam heat are the means of heating, and the ventilation of the shops is under the constant supervision of the plant physician.

It is seen that the plant physician's help goes further than tying up a cut finger or comforting a headache or backache. His job is not only to help the employee after an illness or accident has developed but to do all he can to prevent that illness or accident.

The day of guess work in lighting an industrial plant is a thing of the past. No longer is it said that this or that department is light enough because it looks that way but because the foot-candle meter registers it so. The foot-candle meter is an instrument that records the intensity of light. The lighting code of Ohio specifies a certain intensity of light for each department, depending of course, upon what kind of work is being done, and through the use of the foot-candle meter the intensity is determined.

The chief electrician sees to it that each machine on which an operator is working has sufficient light according to this instrument. Such precautions constitute a real investment. Psychologists tell us that fatigue is easily brought about where eye strain, due to improper lighting, is incurred. This fatigue is bound to make itself noticeable in the quality of the work done. To be certain that every man has the proper lighting around the machine he works with is as important in a machine shop as are the tools with which he works.

Make Guards Before Accidents Happen

In many instances guards on machinery do not make their appearance until after an accident. There is, of course, a limit to the precautions that should be taken. If a man is careless he is going to injure himself regardless of all the guards that can be devised. The thing the safety committee keeps in mind in this respect is to make guards for moving parts that offer a hazard even with a due amount of care. Their efforts are confined to making these guards before the accident happens. That is when guards serve the most good and that is the purpose of this phase of the committee's work—not merely to prevent future accidents, but to prevent any accidents. In this respect, the work has been a complete success as there was no serious accident during the war and has been none since.

When it is necessary to do any repairing, whether to the equipment or to the shop, the job requires the supervision of a man skilled not only in handling labor but in doing the job right. The boss of such work is the general labor foreman, who takes care of moving heavy machinery, repairs floors and buildings, and superintends all such work that does not require the services of mechanics.

He superintends the building of scaffolds; has windows and floors of shops cleaned at regular intervals; has ropes replaced that show signs of wear; instructs laborers as to the best method of handling heavy loads; and keeps all fire-fighting equipment in condition. In short, he is a general overseer of all work requiring unskilled labor.

In doing such work he is always on the alert for better ways of handling things and any suggestions he may have are put up for discussion at the safety committee meetings.

Another welfare feature is the Mutual Aid Society conducted by the employees for their own benefit. The officers are elected yearly from among the employees and in its 20 years of existence the society has accomplished inestimable good.

The dues are 50c. a month and for this the employees while sick receive $9 per week after the first week's illness. This sick benefit insurance is paid for 26 consecutive weeks. In many cases however, it has been paid for longer periods depending, of course, on the circumstances. In the event of death, the sum of $50 is paid to the beneficiary.

For an additional 50c. per month employees are insured for $1,000 under a blanket policy held by the company. For each five years of service this insurance is increased $100 without extra premium.

From the foregoing it is seen that not only is the workman's health safeguarded but his family is assisted in the event of his illness or death.

These things the workman appreciates. He feels that the firm is interested in him beyond merely what he is able to produce and the result is that he takes a

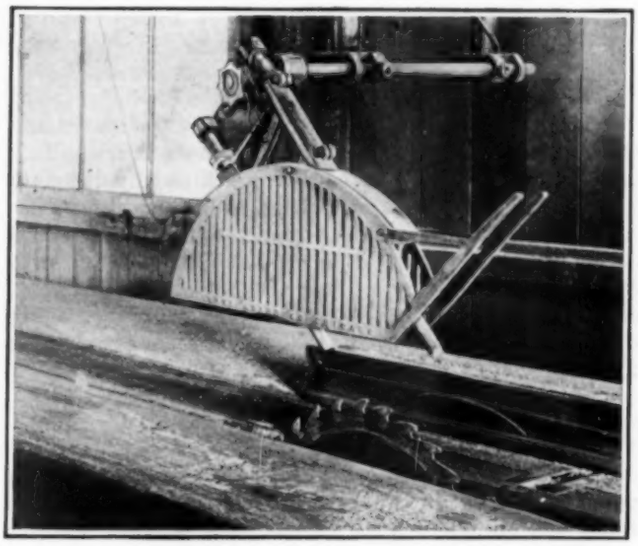


Fig. 7—Guard over rip saw. The guard always covers the saw during cutting

wholehearted interest in his work. It is needless to say that such a feeling between employee and employer is worth a whole lot of money and is the means of securing a maximum amount of work from each man where other methods fall flat.

The labor turnover is one of the smallest of any big factory in the United States. Many men who have been induced to leave for higher wages return. On being questioned as to why they returned they usually say, "Oh, I just like to work here, that's all!" This condition shows that the actual dollars and cents return they receive does not play the tremendously important part one may believe. It is undoubtedly the environment in which they work and the treatment they receive, plus a standard wage, that makes them anxious to return.

After all, taking care of the workman is not a one-sided affair, because both employer and employee are benefited and it is hoped that the changes for the better in the near future will not be the result of laws but because it is clearly seen that all concerned will be considerably improved.

Symboling of Parts for Interchangeable Manufacture

By C. H. Lage
Chief Engineer, The Linograph Co.

IN THE manufacture of machines that have large numbers of strictly interchangeable parts, it is necessary that a system of part names and numbers be established that will cover each item that goes into the construction of the machine. This will enable the various parts, unit assemblies, etc., to be ordered out of stock for assembly, and allow orders sent in for repairs by the customer to be filled, without the confusion that invariably creeps in when a thorough system of part names and numbers has not been established. The names must be so worded that they will convey a definite meaning. The name should show the relation the piece part has to the unit of which it is a part, or the part to which it is adjacent, and the parts should be arranged consecutively according to the relation they have to each other, thus:

Vertical Starting Lever
Vertical Starting Lever Shaft

When the machine has a large number of parts and the part numbers would run into four figures, it is usually preferable to have the machine divided into units or classifications according to the working relations of the various parts to each other. Each classification should have a series of numbers starting with No. 1 and preceded by a letter thus: A-1, A-2, B-1, B-2, etc. When establishing the numbers, the succeeding number should be the part that has the closest relation to the preceding number, thus:

B-42, Vertical Starting Lever,
B-43, Vertical Starting Lever Shaft.

If two or more models are made of the same type of machine, the classification letter should be preceded by the model number. This number will indicate whether the part is interchangeable from one model to the other, thus:

1-3-12B-42, Vertical Starting Lever,

indicates that this part is interchangeable on Models 1, 3 and 12.

1I-16, Magazine Distance Bar,
3I-16, Magazine Distance Bar,
12I-16, Magazine Distance Bar,

indicate that these parts are peculiar to their individual models.

In order to keep a permanent record of all symbols and prevent confusion when the part is replaced by a new design, the part number should not be dropped from the records, but the same number, with a letter added, should follow the old number, thus:

I-2, Magazine Back Plate,
I-2b, Magazine Back Plate,
I-2c, Magazine Back Plate,

in which "b" indicates the second design and "c" indicates the third design.

The serial number of the machine on which the new design became current is of the utmost importance. In order to have this information always before you the first and last machine number on which it was used should always be placed at the end of the part name, thus:

	First Used	Last Used
I-2, Magazine Back Plate	1	99
I-2b, Magazine Back Plate	100	773
1-2c, Magazine Back Plate	774	

By this method, a symbol that is once established is never dropped. It is impossible to give the customer the wrong part if the serial number is referred to. It is at once apparent how many designs have preceded the current design and if it is interchangeable on all models of machines.

State Salary Wanted in First Letter—Discussion

By H. L. Wheeler

On page 12, Vol. 61, of the *American Machinist* and under the above caption Entropy has said a few things about a subject to which little thought has been given, and I think it is one deserving more attention than he has bestowed upon it. Therefore I would add some reflections, with a view to helping the employer get better results from this class of advertising and incidentally to avoid placing extra embarrassments upon the men who apply for the position advertised.

Employers advertising for a particular type of man to fill positions of responsibility are not much in the habit of putting themselves in the other fellow's place, and consequently they often waste a lot of time and some money—and not infrequently get the wrong man. On the other hand, the men who receive replies and appointments for interviews are often put to considerable expense, and many of them fail to make a connection. On the whole there is much dissatisfaction, and it seems to me that there is room for improvement.

From long observation and study of this class of advertising it appears to me that a large part of the fault may be traced directly to the advertisement. Although it is presumed that such advertisements are written without malice aforethought, or intent to deceive, nevertheless they are many times deceiving.

Take the following example. An employer is looking for a man to fill a position and forthwith advertises, to wit:

> "Foreman wanted for machine shop. Must be an executive, able to keep men busy and get out the work right. Must have knowledge of machine tools, including grinding machinery and presses. A permanent position for the right man. Address reply, stating experience and wages wanted.

Four lines of this advertisement are superfluous words, occupying space that could be filled to better advantage to both parties by words that would carry a message to the man and enable him more intelligently to reply, and thus save time for the prospective employer.

From my experience in advertising for help I have found the number of replies to vary from fifty to two hundred, and I have been told by men of long experience that single advertisements have been known to pull as high as seven hundred replies. A large part of these replies come from men who have not the slightest qualification for the position, and the time wasted in going over such replies in order to get in touch with the right man is apparent. The fault is in most cases with the manner of wording the advertisement.

Methods of Machine Tool Design

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

Accuracy requirements in machine tools and provisions for taking up wear—How wear is minimized—Design of Vees, dove-tails and square locks—Arrangement of gibs

THERE are, perhaps, more problems to be solved in the design of a machine tool than in that of any other kind of machine. Not only are the requirements more strict, especially those referring to rigidity, but it is more difficult to meet these requirements on account of the necessity of maintaining a high degree of accuracy throughout the life of the machine. Considerable looseness can be tolerated in the parts of a steam engine without impairing its functions, but as soon as any appreciable looseness has developed in a machine tool it becomes necessary to readjust the machine and to take up this looseness. Moreover, when taking it up, certain relations between the parts must be maintained. For instance, it is not sufficient to simply take up the looseness in the spindle of a lathe, but this take-up must be so arranged that the alignment of the spindle remains correct. These things are well known by the shop man and he looks, almost automatically, after this proper alignment. It is up to the designer to furnish the means for the maintenance of this alignment. It is not nearly as easy to foresee all the cases which may come up when putting some lines on paper as it is to realize that a case has come up when actually adjusting a machine.

The factors which will minimize wear are sufficient rigidity of the parts, light unit pressure, and good lubrication. To these might be added, in certain classes of machines, protection from dust and grit. When all these things have been properly cared for there still

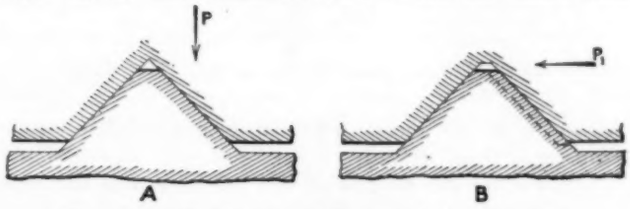


Fig. 253—Vertical and horizontal pressures on a 90-deg. Vee

remains the fact that the parts of a machine will wear. The second point, then, to be considered by the designer is the construction of the parts so that this unavoidable wear will have a minimum effect on the alignment and accuracy. Finally there still remains the fact that in the course of time wear must have some effect on the accuracy, and it becomes necessary to provide means by which the accuracy and alignment can be re-established.

Confining ourselves to the sliding parts of a machine, we find that it is relatively easy to meet the first set of requirements. As a rule, it is not difficult to hold the unit pressure down by providing sufficient bearing surface. We have already seen that, even in the case of boring mills and planers where very heavy loads have to be supported, it is not difficult to hold the pressure down to an amount as low as 50 lb. per sq.in. It is not always so simple to provide proper means for lubrication, and it is particularly difficult at times to prevent dust and grit from creeping in between the bearings. Another problem which cannot always be satisfactorily solved is to give the proper amount of rigidity to a machine part. There are cases where handiness and the capacity of the machine do not allow heavy parts and wide surfaces. For example, the tool slide on a lathe is necessarily held down to a certain height and cannot be widened without affecting the handiness and capacity. In all such cases one should make the bearing surface as large as possible and try to obtain rigidity by the greatest possible thickness of metal.

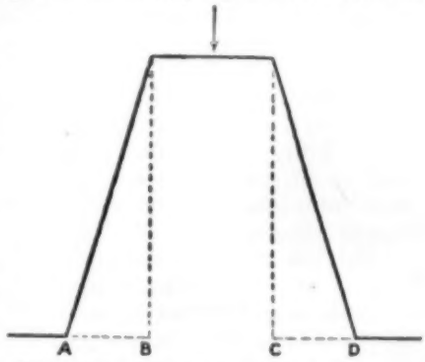


Fig. 254—Type of construction required with small included angle

The means for reducing the effect of unavoidable wear lie in the shape and proportions of the guiding surfaces. Altogether, only three different systems of guiding surfaces are in use—Vees, square locks, and dove-tail locks. It is true that once in a while a cylindrical guiding surface is used, but these cases are rare and, even though they are used, it can hardly be said that they are sliding surfaces in the true sense of the word.

When Vees are used, the male Vee may be in the sliding part and the female in the stationary part, or vice versa. An instance of the first system is the planer, and one of the second system is the lathe. Wherever the Vee is used it functions as a support and as a guide. It is possible to provide a Vee of large proportions in such machines as the planer, but lathe Vees have to be kept down to smaller proportions. As a consequence, the wear on the Vees of a lathe is considerable and, furthermore, this wear has a decided effect on the accuracy because there are no means for

For the author's forthcoming book. All rights reserved. This is the twenty-first article of the series. The twentieth was concluded on page 949, Vol. 61, No. 25.

compensation. For this reason it is advisable to make the ways of a lathe extra hard, either by chilling them or by making them of pieces of hardened steel laid in the bed of the machine proper. In this case the male Vee, being so much longer than the carriage, will have a tendency to wear the carriage evenly, so that there is no other disturbance of alignment than that of height and this is of no great importance.

However, when both Vees of bed and carriage are made of the same kind of material and, therefore, of

Fig. 255—Effect of wear on plain Vee. Fig. 256—Construction to reduce inaccuracy through wear

approximately the same hardness, there will be a tendency to wear the Vees of the bed unevenly, the greatest wear occurring at that part of the bed where most of the work is done. The result will be that the lathe is no longer capable of producing a straight piece of work. The use of Vees in a lathe makes it almost impossible to use the same machine for roughing and for accurate work. If great accuracy is the object, a lathe that is not used for roughing operations must be chosen. The reasons why the Vee is still in favor for lathe construction are of an entirely practical nature. If the problem were merely the design of a machine that would retain its accuracy even when called upon to do heavy work, and if no consideration had to be paid to costs, it is very probable that the Vee would not be used in the construction of the lathe.

The Vee may be made with various angles. At *A* in Fig. 253 a Vee with an included angle of 90 deg. is shown, each side making an angle of 45 deg. with the vertical line. With such construction, if there is wear due to a downward pressure *P*, the wear will occur on both sides, the slide will drop vertically, and there will be no change in the horizontal adjustment. If, on the other hand, there is a horizontal pressure P_1 as shown at B, the wear will occur on one side of the Vee only and the slide will be displaced to the left, as well as downward. Any angle of pressure between these two extremes will cause a displacement both downward and sideways.

The question now is what angle to select for the Vee

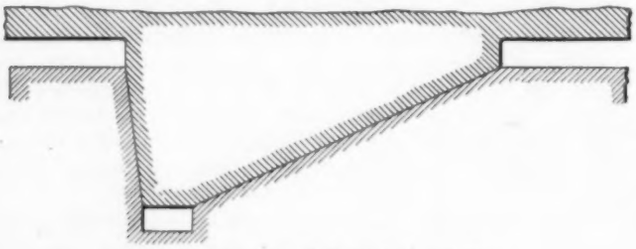


Fig. 257—Special design of Vee

in order to have a minimum of objectionable displacement. We see right away that if the pressures are all applied vertically, or nearly so, we should have either a flat guide or a Vee with a very obtuse angle, whereas, if the pressure is mostly or altogether horizontal, we should have a Vee with a very acute angle or a straight-sided guide.

Take as example the planer guide. When using a planer, the weight of the table plus the weight of the work is generally greater than the pressure exerted by the tool. The pressure of the tool is partly downward and partly horizontal and, in some cases, it may actually be upward and horizontal. As a rule, it can be said that the Vee should be designed chiefly for vertical pressure, but in order to meet occasional conditions, such as the up-thrust due to a cut with the side head, we must be careful not to make the Vee too flat. Included angles of 120 deg., sometimes 110, and occasionally 100 deg., are taken for the Vees of a planer.

A very heavy planer table carrying very heavy loads, such as may be found in steel works, would require flat Vees. Such planers are often made with one Vee and one square lock, and occasionally with two square locks. In such planers heavy cuts are taken, but the pressures due to the heaviest possible cuts are relatively small when compared to the weight of the table and work. On the other hand, in a frog and switch planer the table is relatively light. The work upon it is also light, but the cuts are very heavy. In this class of machines the side thrust due to the cut would be sufficient to displace the table sidewise if flat Vees were used, and angles of 100 deg. or less are common. There are even

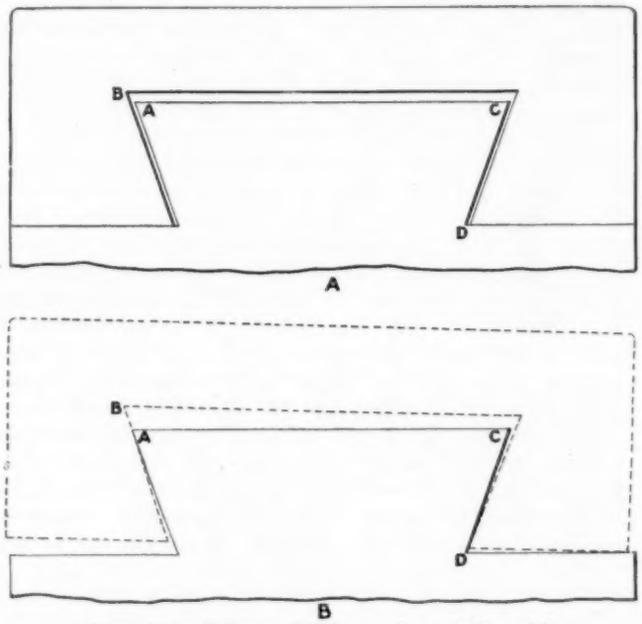


Fig. 258—Effect of lift on dove-tail guide

cases in which a gib is provided to positively prevent the table from lifting.

In a lathe the weight of the carriage plus the downward pressure on the tool has a tendency to keep the carriage down, but the back thrust against the tool and the side thrust due to the feed have a tendency to move the carriage off the Vees. As the carriage is light compared to the pressures of the cut, it may well be that the tendency to move the carriage off the Vees is as great or even greater than the tendency to hold it down. Here, again, a rather small included angle is required. On very large lathes, such as are used in steel works or for the turning of heavy steel castings or forgings in other shops, the pressures on the tools may be very much greater than the weight of the carriage and in such lathes it would be unsafe to use Vees except with very small included angles.

It might be asked why the small included angle is not used for the heavy lathe. Fig. 254 shows in diagram-

matic and exaggerated form what would happen if such Vees were used in heavy lathes. If the full line represents a Vee with small included angle, all the pressure on the carriage must be taken up by the projected areas, *AB* and *CD*, of the sloping sides. Since the pressure is great, this projected area must be large and

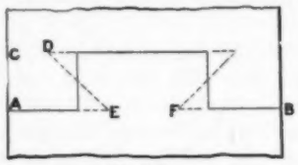


Fig. 259

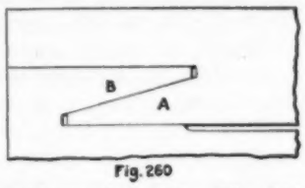


Fig. 260

Fig. 259—Effect of dove-tail angle on strength. Fig. 260—Parts weakened by large dove-tail angle

the Vee must, therefore, be very high. This, in the first place, would weaken the carriage; in the second place, it would cause a wedging effect between carriage and bed; and in the third place, a small amount of wear would cause the carriage to be displaced downward a large amount. These three reasons are always sufficient to exclude the use of Vees with a small included angle when large pressures have to be taken care of.

There seems to be a great deal of doubt as to when and where Vees are no longer practical. The criterion is this: Unless the relation between vertical and horizontal pressures is such that an angle of 90 deg. or more can be used, no Vee should ever be used. In addition, no Vee should be used if it tends to weaken the slide.

The wear of the upper part, shown at *A* in Fig. 253, would cause the two parts to come in relation to each other as shown in Fig. 255 on a somewhat enlarged scale. As will be seen, shoulders will have been worn in both Vee and slide. The Vee should be constructed as shown in Fig. 256 in order to avoid this.

There are cases when it is advisable to use Vees with one side steep and the other relatively flat, as shown in

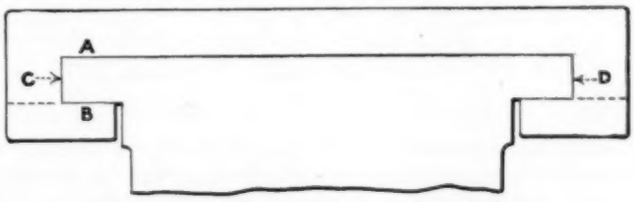


Fig. 261—Simple form of square lock

Fig. 257. Let us imagine a machine in which a fairly long table is adjustable on a long bed, the work being subjected to such an operation as trephining. The adjustment of the table is made by a screw that also takes care of the pressure of the tool in the direction of the axis of the bed. The pressure of the cut at right angles to this axis must be taken by the Vee and, if such a table is supported on two Vees, one should have the steep side on the right and the other on the left. The flat sides provide the necessary area to take care of the weight of table, work, and downward pressure.

It might be asked why the steep side is not made vertical and the flat side horizontal, because this arrangement would certainly take care of both horizontal and vertical pressures. Such an arrangement would be all right if the table were short and could be provided with proper gibs, but as the table in such a machine might have considerable length, gibbing would be impractical. It would be necessary to scrape the table to the bed without any error either horizontally or vertically and there would be absolutely no means for taking up subsequent wear. Making this table with the Vees, as shown, permits scraping to a bearing by trial and error and, at the same time, provides proper means for taking up.

Dove-tail slides and guides are used a great deal and, perhaps, a little more than they deserve. Their bad features do not show up with light work, but the designer should be very careful in making an analysis of the dove-tail slide when the work to be done is heavy. Square guides and dove-tail guides are often called square locks and dove-tail locks, because the construction automatically prevents the slide from being lifted away from its supporting member. Though a dove-tail guide prevents a slide being lifted clear off from its supporting member, it does not prevent it from being lifted to a certain extent. This is due to the unavoidable clearance, shown exaggerated at *A* in Fig. 258, which must exist between two relatively moving parts.

In Fig. 258 at *B* this lifting effect is shown in an exaggerated form. It should be remarked that though

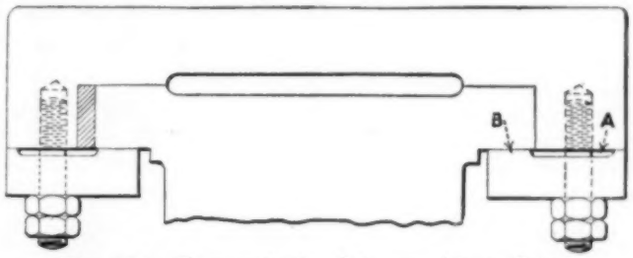


Fig. 262—Square lock with one side and two bottom gibs

no such amount of lift will ever take place in a machine tool in fair condition, yet there is some lifting and, unless the proportions of design are correct and the adjustment of the machine in good condition, this small amount of lift may be detrimental to the proper working of the machine. The amount of lift is affected by the amount of looseness originally allowed, by the angle between the horizontal and sloping sides of the dove-tail, and by the distance from *A* to *B*. It becomes smaller when the distance from *A* to *C* increases. The angle *ACD* is particularly important. If this angle approaches 90 deg., a very small amount of looseness will permit a large amount of lift. Not only that, but in this lifted position there would be a very great wedging action between the sliding member and its support, with a consequent excessive wear and perhaps an abso-

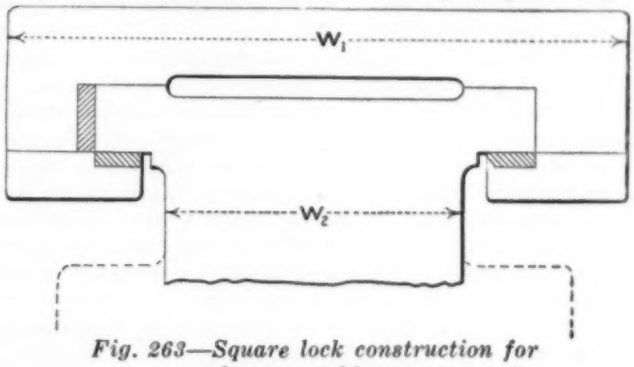
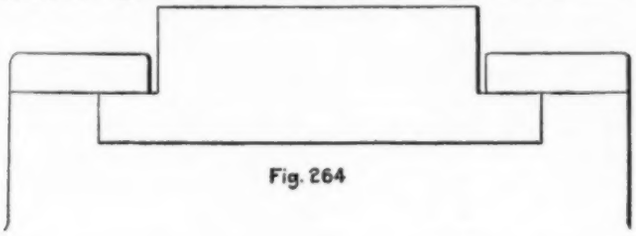


Fig. 263—Square lock construction for heavy machinery

lute locking. Such dove-tails are never made and they are only mentioned here because what happens in a large degree when the angle *ACD* approaches a right angle, happens in a smaller measure when the angle is more than it should be.

One of the chief reasons why relatively large angles are used is an entirely practical one. When we say practical, we mean that the considerations leading up to that construction do not deal entirely with the proper functioning of the machine, but with facilitating the design or the construction. In Fig. 259, for instance, if the available room for a slide is the distance from *A* to *B*, we will get the greatest possible strength in both members if the slide is made as shown in full lines. If we change it over to the design shown in dotted lines,



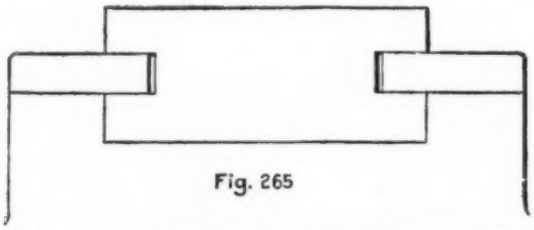


Fig. 264—Square lock construction to increase strength of guide. Fig. 265—Arrangement to prevent entrance of chips and dirt

the upper slide is weakened at points *C* and *D* and the lower slide at the points *E* and *F*. If the total distance *AB* is small to begin with, the designer will naturally look for some construction which will give the greatest possible strength for both members, and the natural thing to do is to make the angle *DEA* as large as possible. There would be no great harm in making this angle fairly large if the pressures were always either downward or sideways, but if, on the other hand, there is a possibility that upward pressures may exist, the large angle is not permissible.

The angles of dove-tail most commonly used are 30 and 45 deg. with the vertical. The 30-deg. angle is largely used for tool slides, etc. when there is no lifting tendency, and the angle of 45 deg. is used when such a lifting tendency exists. An example of the first is the front tool slide of a lathe, and one of the second is the rear tool slide. Where both tool slides have one common base, the angle of 45 deg. should be used for both sides. Compromise angles between these two are also used, though not often. Angles greater than 45 deg. should not be used at all. One of the disadvantages of too great an angle is the weakening of both members. This effect is, again in exaggerated form, illustrated in Fig. 260 where both the upper member *A* and the lower member *B* have a very weak projecting lip. In addition, the difficulties of scraping become greater with increasing angles.

The simplest kind of square lock is illustrated in Fig. 261. In this construction all possibility of upward or downward movement or of sidewise displacement is eliminated, except such little amount as may be due directly to the unavoidable clearance between the two members. However, such construction is impractical except for very large machines. Scraping the surfaces *A* and *B* of the upper member becomes exceedingly difficult. In addition, if the result of the scraping is not absolutely perfect there is no possibility of further correction, so that, as a rule, this construction is made as shown by the dotted lines. These indicate that the upper member is made in two parts and scraping thus becomes relatively easy. However, there is still no possibility of correction at the points *C* and *D*, so that gibbing is necessary.

There are many ways in which the square-lock construction can be carried out. Fig. 262 shows a simple construction having two gibs at the bottom and one gib on the side, the gibs on the bottom being relieved so that they can be used as clamps. Where there is no necessity of ever clamping the upper member to the lower one, the gib is preferably made without relief. If in the course of time looseness develops in a vertical direction, the gib can be removed, the upper members scraped at the points *A* and *B*, and the gib replaced. When it is necessary to clamp the upper member occasionally, the relief indicated is sometimes provided. In that case the gib is held to the upper member by means of some studs with locknuts to prevent the gib from sagging down and, in addition, with one or more clamping bolts to permit the gib being pushed up. As soon as the clamp bolts are released, the gib will assume its original position. A better construction is to cut the gib in two or more pieces, some of which are arranged as gibs and some as clamps. The only excuse for the use of the same piece as both gib and clamp lies in the shortness of the gib. The double use of the piece is never to be recommended.

A construction recommended for heavy machinery is shown in Fig. 263 in which one side gib and two bottom gibs are used. This construction is equally good for smaller machinery, but the percentage of increase of

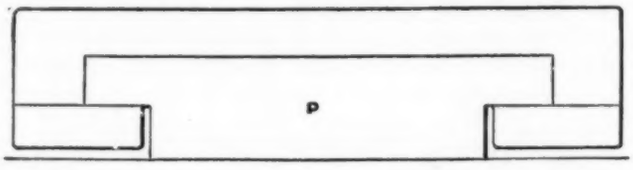


Fig. 266—Square lock with guide separate from frame

cost due to this more complicated construction is, of course, greater in the small machine than in the large one, and may become prohibitive. When the arrangement of Fig. 263 is used, and particularly with large machinery, it becomes possible to use the construction shown in Fig. 261, but modified to the extent that the three gibs are used. Here the sliding member is made all in one with the lower gib. It should be noticed that the lower gibs of Fig. 263 were made separate from the main casting only for the purpose of machining and scraping. When separate take-up gibs are used the greater part of this difficulty disappears.

As will be seen from Fig. 263 the width W_1 of the slide is much greater than that of the supporting member W_2, and this condition is what leads, as a rule, to the dove-tail construction. In many cases W_2 would be insufficient for strength and rigidity. It is, of course, possible to widen the lower member as shown in dotted lines in Fig. 263, but as a rule there is a certain amount of mechanism connecting upper and lower slide that must find its bearings and the necessary room for gears, etc., in the narrow neck W_3. Consequently, the widening out has not helped to make the construction practical. This handicap is not often found in large machinery, but it is quite common in the smaller kind and this is, perhaps, the main reason why the use of

square locks is quite common in heavy but not in light machinery.

Instead of having the sliding part wide and the supporting part narrow, the opposite construction may be used. However, this is not a solution of the trouble mentioned above, unless there is no restriction as to the width of the stationary part. If there is such a restriction, the sliding member would become too narrow. However, this narrowness would not, as a rule, impair the strength of the sliding member because its height is generally limited. Fig. 264 shows such a construction. Gibs are not shown in this diagram because the nature of the gibbing may be the same as that shown in the previous illustrations. It will be noticed that one objectionable feature of this construction is that there is an opening left between the upper gibs and the sliding piece which is liable to collect dirt, chips, etc. On the other hand, possibilities for lubrication are better.

Still another construction is shown in Fig. 265, in which the vertical opening is avoided, and this construction is often used on smaller machines. Still another modification is shown in Fig. 266. In this case the slide rests on a plate *P* fastened to the bed or other stationary member of the machine. This construction is particularly handy for special machines where slides have to be adjusted after the machine has been practically completed. The building of a special machine does not permit the use of complete sets of gages, as this would be too costly, and the final adjustment must be made by trial. By using a bedplate with a flat surface, various plates *P* of different lengths, widths and heights can be provided according to the requirements of the slides, and may be adjusted to the correct direction.

Management Methods Must Change with the Times

By Fred H. Colvin
Editor, *American Machinist*

THE establishment of a fetish is an obstacle in the path of progress. It is for this reason that engineers who appreciate the possibilities of better and more efficient management deprecate the tendency tc put any one man or one method on a pedestal and pronounce him or it, the ultimate to be obtained. Every engineer appreciates the work done by Mr. Taylor but some seem to forget that the twenty-one years that have elapsed since the publication of his book on scientific management have witnessed changes that make many of his methods inadequate and ineffective.

Mr. Taylor's plan was founded on the master and man idea, which even then had begun to pass. He relegated the worker to the status of an automaton, whose every move was thought out and planned by supposedly superior beings in the planning department. Even at that time, before the individual had begun to be seriously considered in large organizations, the introduction of the system either in whole or in part, was the cause of much unrest, culminating in strikes in many instances. This resentment to the introduction of new methods of management was considered by Mr. Taylor and his followers as evidence that men were naturally loafers and had to be driven by discipline and coaxed with wage incentives.

Why Time Study Was Opposed by Men

It was this attitude which was responsible for the fight against its introduction into the government shops, and caused the regrettable, sweeping condemnation of "stop watches and premiums." In view of the violent objections to the Taylor system, it is interesting and significant to note that a number of other shops succeeded in securing the co-operation of organized labor in applying methods, which secured the results Taylor sought—increased output at lower unit costs.

In reality, much of the resentment was against the stop watch being too frequently in the hands of men without judgment, and against the exemplification of manual labor by comparing it with the gorilla. The assumption that the hand worker is devoid of brains or reasoning power, and that every move must be planned for him, caused more discontent than many appreciated. We have learned from such men as E. W. Hewlet, Robert Wolf and others that men are anxious to increase production when relations are congenial, and increased wages are not the only incentive to greater production.

All Brains Not in Office

Mr. Taylor was a pioneer in showing us that production could be increased by a study of the elements going to make up an operation. We have followed his methods and improved upon his practice until in some lines of work the labor cost is almost negligible. But this has not been accomplished by military discipline or neglecting all the brains of the organization outside of the planning department. The foremen and the key men are consulted before a new machine is bought or a new method introduced. In some shops both the foreman and the key man O.K. the sketches for fixtures and tools before they are built. This method secures the benefit of their ideas, and they frequently have good ones, and it also insures their hearty co-operation in making the tools and fixtures work as they should.

The greatest criticism of Mr. Taylor's method, from the viewpoint of 1924, is that it did not include the human element. This element we now know to be of the greatest importance and our realization of it is growing each year. And the country is to be congratulated on the fact that this is so. When the workers, the bone and sinew of any nation, are content to be placed in the gorilla class, and to have all their thinking done for them, that nation is in danger.

This criticism of Mr. Taylor does not mean that careful planning and direction are not necessary. Both must be better understood and practiced. But the modern methods seek to secure real co-operation between workers and managers in place of the blind obedience which Taylor demanded.

No one man or set of men have a monopoly of brains or of truth. Let not our admiration of the man blind us to the shortcomings of his methods as applied to present-day problems. For this may easily prevent progress along the line in which he was so keenly interested.

Presented at a joint session of the Management Division of the American Society of Mechanical Engineers and the Taylor Society, Dec. 4, 1924. A discussion of Fred W. Taylor's paper —Shop Management—originally presented at the 1903 spring meeting of the A.S.M.E. and re-presented by Morris L. Cooke at this session.

Steel Tapes for Measuring Large Diameters

By George C. Reilley
Supervisor of Tools and Gages,
General Electric Company, Schenectady

THE use of steel tapes for measuring large diameters has grown steadily with the General Electric Co. since the war. At that time, the making of gears for turbine reduction-gear sets for ship propulsion called for measurements of exceptional accuracy. Because of the size of the gears and the accuracy desired, a "snap" or "outside" gage could not be used for finishing the outside diameter of the blank and that this be of the greatest possible accuracy, since the engineers would allow an accumulative error of but three-thousandths of an inch in the total periphery of the gear after the teeth had been cut. As the 72-in. gear had 288 teeth, the permissible error was approximately one hundred thousandth of an inch in the circular pitch.

A special machine had to be designed for measuring the length of the tape. To measure the tape, one end is first inserted in the slot in the clamping block *A*, Fig. 1, and clamped. The tape is then passed around the stationary head and around the movable head back to a second slot in the clamping block and butted to its opposite end. A tension of four pounds is used to straighten out the tape. A pin gage of the desired

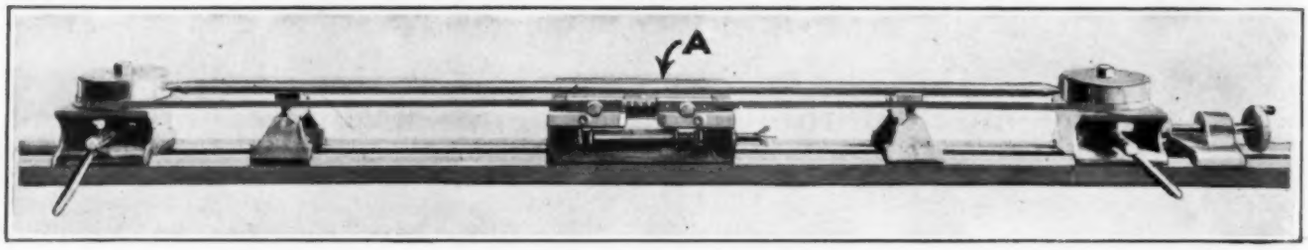


Fig. 1—Tape-measuring machine

it was therefore decided to use a steel tape. The design of the drive of the reduction gears made it necessary that the gear and pinion shafts be on fixed centers with no allowance for adjustment; due to the fact that the teeth on the pitch lines had to mesh without any allowable variation in diametral pitch or thickness of the teeth.

The tape used was made by the General Electric Co. to the length represented by the circumference of the gear blank. As the pitch line of the gear is determined from the outside diameter, it is necessary

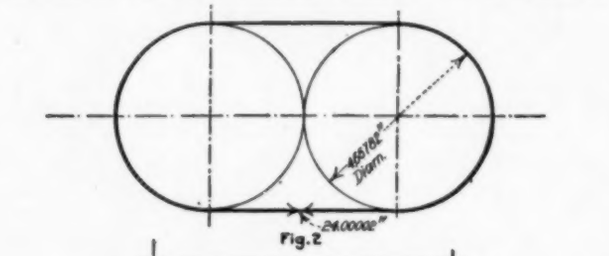


Fig. 2

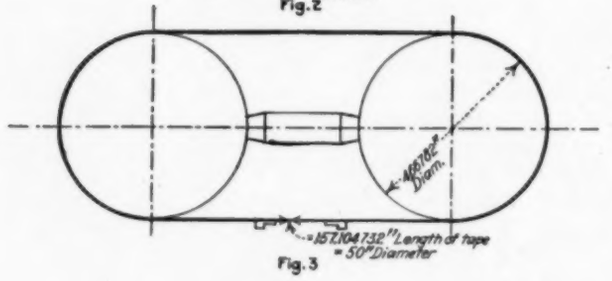


Fig. 3

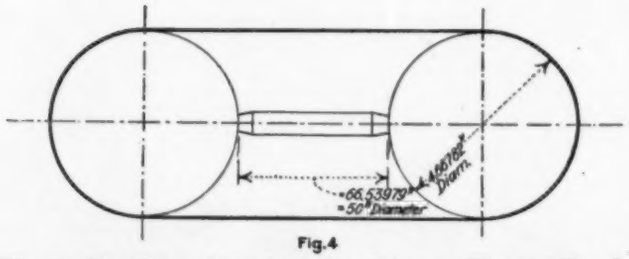


Fig. 4

Fig. 2—Position of heads without tape. Fig. 3—Developed length of tape. Fig. 4—Length of pin gage

length, as determined by Johannson blocks, is inserted between the two heads and should check with the desired length of the tape when calculated according to the following formula.

In Fig. 2, $\frac{1}{2}$ dia. $\times$ 2 $\times$ π + (radius $\times$ 4) = 24.00002 inches.

In Fig. 3, 24.00002 in. + 0.025132 + (pin gage $\times$ 2) = developed length of tape.

In Fig. 4, length of pin gage = developed length of tape $- \frac{24.025152}{2}$

In each instance, the thickness of the tape (0.008 in.) must be considered part of the diameter of the fit. This thickness equals 0.025132 in. in circumference and, for the sake of convenience, after the circumference of the diameter has been obtained, this is added. For example, the actual circumference of 50 inches is 157.0796 and, with the thickness of the tape added, it makes the actual length of the tape 157.104732 inches.

After the tape had been successfully used in the instance cited, the practice soon found general acceptance at Schenectady and, later, at other General Electric plants. Steel tapes are now recommended at Schenectary for measuring any circumference where the diameter exceeds three feet and even smaller, where unusual accuracy is desired.

Long Locomotive Runs Save Coal

Longer runs for locomotives are gaining ground and show economy in several ways. Where the run used to be 90 or 100 miles, 200 is now common, and nine railroads have regular runs of over 500 miles, while a few exceed 600 miles and one is 815 miles. Crews are changed as often as necessary but the locomotive goes on.

The advantages are increased railroad capacity, less locomotives required, less room at terminals and a saving in fuel, amounting to 20 per cent, owing to fires not being banked for such long periods. The total coal consumption of railroads in the United States is 25,000,000 tons a year.

Ideas from Practical Men

Cutting Internal Gears on a Shaper

By Herbert F. Crawford

Part of the mechanism for handling the tower ladders now used so largely by fire departments in various cities, is a large internal gear having 270 teeth of 5 pitch and a pitch diameter of 54 in. Cutting the teeth in such a gear becomes quite a problem for a shop not equipped with a very large gear cutter. The Ahrens-Fox Fire Engine Co., Cincinnati, Ohio, has no gear cutter large enough for this work so devised the method shown herewith.

The gear blank is first turned in the usual manner and the teeth are cut in a heavy-duty shaper by means of the fixtures illustrated in Fig. 1. The ring or blank is held in the frame *A* which consists of a sector at the bottom and an arm that clamps the work near the top of the ring, as shown at *B*. The sector *C* has teeth cut on the outside, which act as an index in conjunction with the worm at *D*.

The fixture is mounted in front of a large shaper which cuts the teeth. Two cuts are made, one with a shaper tool that gashes out the stock and the second with a form cutter made by utilizing a regular gear cutter as shown in Fig. 2. The cutter is bolted firmly to a shank or toolholder and set so that the cutting edge is in position to cut the correct toothform. This arrangement allows almost unlimited use of the cutter, since, beside the numerous grindings that can be done on the first tooth, there are several other teeth to be used.

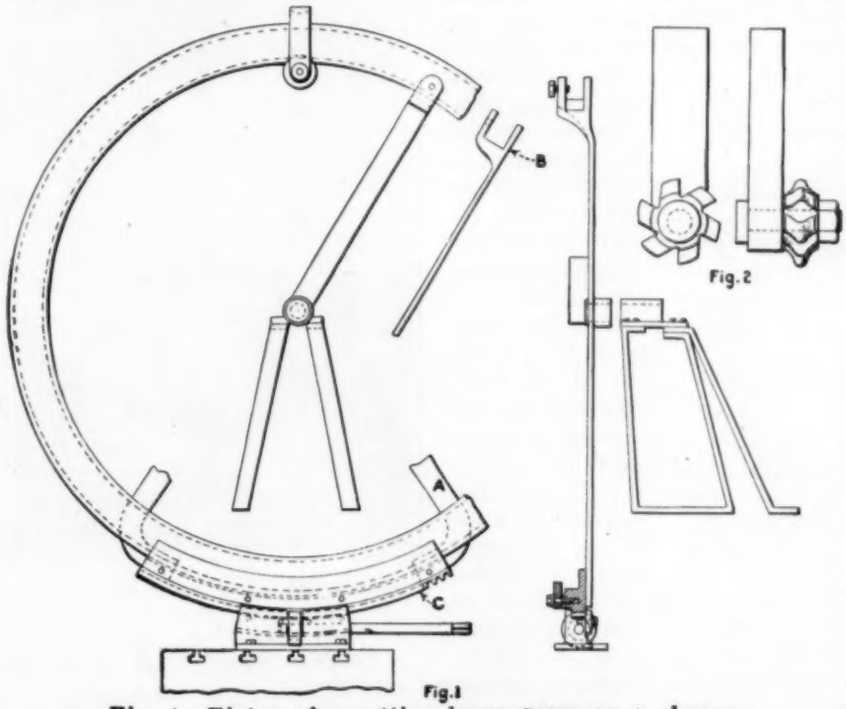


Fig. 1—Fixture for cutting large gears on a shaper.
Fig. 2—The finishing tool used

The gear cutting is done in 9 sections, the gear blank being carefully laid out so that it can be shifted in the fixture from one section to the next. A fixture is being designed, however, that will allow the whole 270 teeth to be cut at one setting. The present arrangement has worked very satisfactorily and gears are cut in very good time.

Work Drivers for the Grinding Machine

By H. J. Gustav Kopsch

Many small parts that have to be ground on centers in a cylindrical grinding machine, have either a short threaded shoulder or a tapped hole at one end, making it difficult if not impossible to use the standard form of work driver usually supplied with such machines.

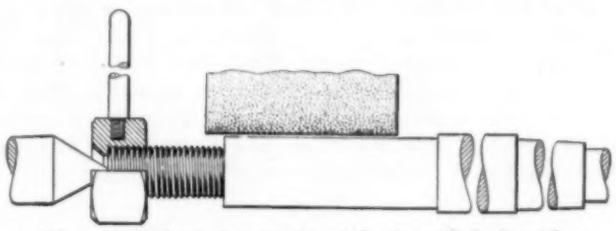


Fig. 1—Driver for work with threaded shoulder

The sketches show a couple of special drivers that I have found very satisfactory and convenient when grinding pieces of this nature.

The driver shown by Fig. 1 is made from a short piece of hexagon bar or from a blank nut of suitable size. It should be tapped only part way through with a bottoming tap, so that when screwed on the threaded shoulder of the work it will stop in the position shown by the sketch. It is important that the unthreaded portion of the hole be large enough, or chamfered out sufficiently, so that no part of the driver will touch the center point of the machine when the latter is entered in the center hole of the work.

A short piece of drill rod is shouldered at one end and threaded or driven into one of the faces of the hexagon stock. The bottoming tap should be run into the hole after the drill rod is in place to make sure that the thread is not interrupted by it.

For the second piece under consideration, the piece with the threaded hole in one end, the driver must provide the bearing for the center point of the machine. Fig. 2 shows the way I make it.

First, I take a piece of round stock of suitable size and thread one end to fit the hole in the work. If the latter is of small size the stock may be left of uni-

IDEAS FROM PRACTICAL MEN

form diameter, but if the hole is so large that the driver would be unduly heavy the long end should be reduced in size. The driver is then bent at a right angle, or nearly so, as shown.

Next, catch a piece of machine steel scrap in the lathe chuck and bore and thread it to the same size and pitch as the hole in the work. Without disturbing it in the chuck, screw in the bent driver, face off a spot

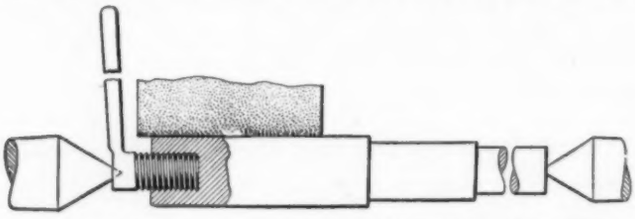


Fig. 2—Driver for work with threaded hole in end

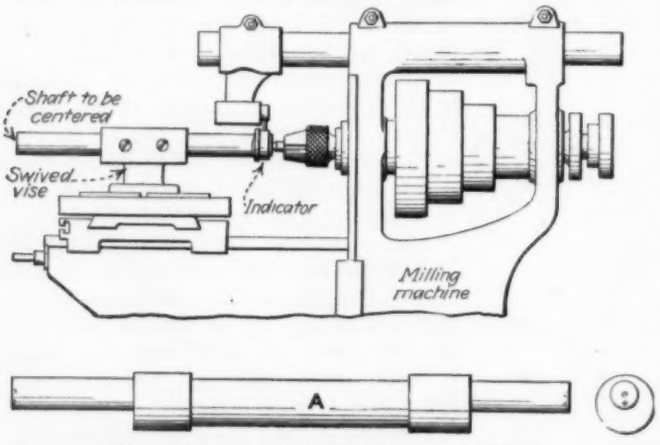
around the center, and drill and ream a center hole with a standard center reamer. The threaded part of the driver will now run true with the center and the latter may be depended upon as one of the centers of the work.

These drivers are light, convenient, and need no wrench to manipulate them. They may be run to place on the work by the fingers of the operator, and to release them requires only a slight tap in the direction of the thread. Neither of them will interfere with the overrunning of the grinding wheel in traversing.

Centering an Eccentric Shaft

By Charles Kugler

Difficulty was experienced with the eccentric shaft *A* on account of not being centered properly until the method shown on sketch was adopted. The shaft was placed in the vise on the milling machine as shown and one end centered. Then the indicator was adjusted to read zero when in contact with the shaft. The vise



How the eccentric shaft was centered

was then swiveled through 180 deg. and the table moved until the indicator read zero when in contact with the other end of shaft. After centering this end, the table was raised or lowered an amount equal to the eccentricity of the shaft. One end was centered eccentrically and the indicator set to read zero. The vise was again swung around and the other end centered.

A Method of Handling Tire and Wheel Work—Discussion

By Johnstone Campbell

On page 587, Vol. 61, of the *American Machinist* there is an article by H. K. Griggs, under the title given above, to which I would like to add our experience.

We handle many wheels from our electric mine

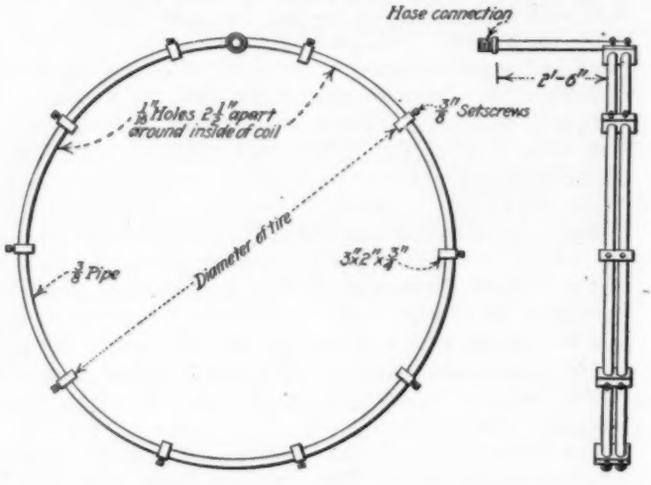


Fig. 1—Double-ring burner for heating tires

motors and cut off the tires with an oxyacetylene torch and shrink new tires on the cast-iron centers with the aid of a Hauch burner and the double-ring heater shown in Fig. 1 which is very efficient.

Our method of handling the tires is shown in Fig. 2 and I think it is a little cheaper than the method used by Mr. Griggs, since we do not require the service of the traveling crane while handling the tires.

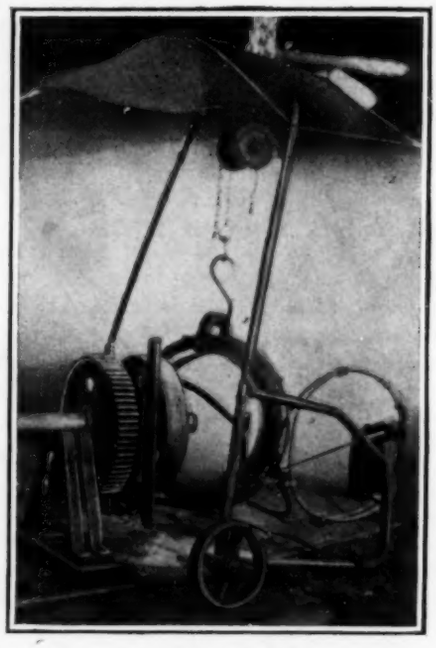


Fig. 2—How the tires are handled

We use a 1,000-lb. chain hoist, slung from the top of a two-wheeled carrier as shown. The carrier is made of 1½-in. pipe and is provided with a hood or canopy to prevent the flame from the oil burner from going too high at the time of lighting.

Both the method and equipment have proved very satisfactory in our shop.

IDEAS FROM PRACTICAL MEN

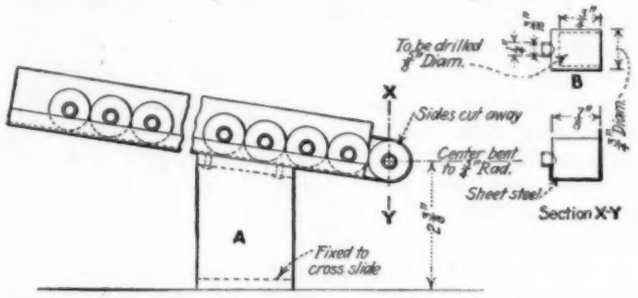
A Magazine for the Automatic

By G. Dodds
Musselburgh, England

The sketch shows at *A*, a simple magazine and chucking attachment I made for use with a ⅜-in. Cleveland automatic, type A.

With this attachment we were able to do the drilling of the piece *B* automatically.

The magazine is fixed to the rear part of cross-slide and timed to reach chucking position—cup in line with collet—after the finished piece has been ejected and



Magazine for an automatic

while the stop in the turret is coming forward to push a new piece into the collet. When the stop moves back, another piece drops into the cup. The slide is then moved back so the magazine will clear the turret tools.

The time between the opening and closing of the collet is made as long as possible by moving the closing cam as far back as it can be set, so as to enable the finished piece to be ejected without fouling the cup of the magazine when it is moving into position.

A short piece of bar in a ½-in. pusher collet, is used for ejecting the finished piece. The bar is kept from being pushed back by a pin through it in front of the pusher collet. When the pusher tube is released upon the opening of the collet, the bar knocks the finished piece out. The end of the bar should then be only about half-way through the collet, so that it will not interfere with the new piece entering the collet freely.

The dimensions of the magazine can be changed to suit other diameters and lengths of work, or to enlarge its capacity.

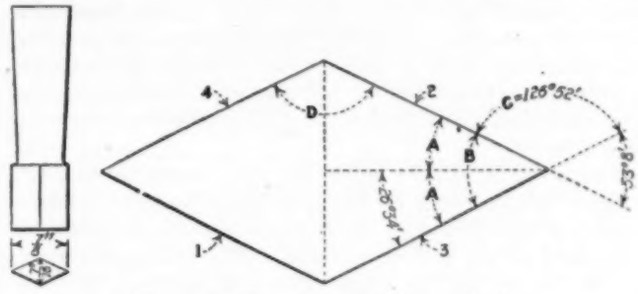
Shaping Punches With a Dividing Head

By J. Davies

Recently we had the job of milling a number of punches to the shape shown in the sketch. Though the punches were of different sizes, they were of the same shape and the same calculation served for all of them.

It will be noticed from Fig. 1 which shows the shape and angles that one angle is exactly twice that of the other. In calculating the angle required we have a right angle triangle the ratios of two sides of which are as two to one; therefore the tangent of the angle at *A* would be 0.500. From a table of trigonometry ratios we find angle $A = 26$ deg. 34 minutes. The complete angle $B = 53$ deg. 8 minutes.

In milling this piece of work it is necessary to rotate it through angle *C*, which is 180 deg. — 53 deg. 8 min. = 126 deg. 52 minutes. Since 40 turns of the index-crank equals one turn of the work, or 360 deg., $\frac{360}{40}$ or 9 is the No. of degrees for one turn of the crank. There-



Shape of the punches to be milled

fore 126 deg. 52 min. ÷ 9 = No. of turns required to rotate the work through the required angle. $\frac{126 \text{ deg. } 52 \text{ min.}}{9} = 14\frac{13}{135} = 14$ turns and 13 holes in a 135 circle.

Side 1 was milled first. The work was then rotated one-half turn and side 2 milled. Then $14\frac{13}{135}$ turns of the index crank brought side 3 into position. Another half turn brought side 4 into position, thus completing the work.

It was not necessary to calculate angle *D*, as that automatically came correct, or to mark off the ends of the punches at all. After the work was cleaned up the size was checked with a micrometer.

Waste of Tires in Turning

By Chas. F. Henry

Some railroad shops in which I have been, waste much good tire steel during the year by lack of care in turning the flange. It frequently happens that the wheel lathe is one of a few machines in the shop that will take a real chip and the men like to see it perform. So they put on a heavy feed across the tread and get so used to the coarse thread it cuts that they continue it on the sides of the flange.

Such a coarse feed leaves deep hollows and high ridges to be smoothed out by the forming tool and it requires the removal of much more metal on the side flange than it does on the tread itself.

If the wheel-lathe man will not take such heavy cuts and make such deep grooves on the sides of the flange, he will not only save time in turning the tire but also steel, which represents many miles of service.

The department, "Ideas from Practical Men," is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for at space rates.

PRACTICAL SHOP PROBLEMS

Questions of a Practical Nature will be answered in these columns

Q. In our factory we are having difficulty in getting gears to run quietly when meshed closely enough to eliminate the backlash. We have on hand a lot of gears that give out quite a loud humming noise when running. Is there any method by which we can make these gears run quietly?

A. It is extremely difficult to have gears run quietly when meshed so closely that there is no backlash. While the gears in automobile transmissions run quietly, they generally have a backlash of from 0.006 to 0.010 in., though perhaps the oil helps to eliminate the noise. The manufacturers find that less backlash increases the noise.

Gears can often be made to run more quietly by burnishing the teeth by running them in mesh with a hardened master gear. Both gears should be mounted in a rigid frame and on parallel shafts. The soft gear should be run in the same direction as when in use. The master gear must be very accurate, and it will probably be necessary to grind or lap the teeth to secure the necessary accuracy. The burnishing process appears to "iron out" any minute wrinkles left by the cutter.

Sometimes mating gears are run together, either with or without a very fine abrasive. In the Lincoln plant, it is the practice to polish the gear teeth after burnishing, as described on page 954, Vol. 59, of the *American Machinist*. The gears are hardened after burnishing and before polishing.

Q. Can you tell me how to blue finished springs and other parts?

A. A dark blue color can be secured by immersing the parts in a bath consisting of 10 parts niter (salt peter) and 1 part black oxide of manganese, heated to a temperature of from 800 to 850 deg. F. The parts should be in the bath for a length of time that may vary from a few seconds to a few minutes, depending on their size and nature. Parts that will not warp in quenching may be plunged in cold water. Thin pieces are generally allowed to cool before being dipped in water. In either case water must be used to remove the niter. After the niter has been cleaned off, dry the pieces quickly to prevent rust and apply a coating of light oil. It is necessary to have the parts clean and free from grease if a uniform color is desired.

Springs are generally drawn back at from 450 to 600 deg. F., depending upon the analysis of the steel. Higher carbon content requires higher temperature. To get good results have the springs clean and then heat them on the surface of a layer of sand, contained in a pan, either in the furnace or by a fire applied underneath the pan, until the color desired has been obtained. The parts should be turned occasionally during the heating, and after the coloring has been completed, they should be spread out to cool.

Q. By regrinding automobile cylinders and fitting new pistons, will the compression be improved? In making new pistons, should the wristpin holes be raised or lowered to increase the compression, and just how much in comparison to the amount the area has been increased by the removal of metal in grinding?

A. When cylinders are worn sufficiently to require regrinding, there is no question as to the compression being improved by having the bores restored to roundness, and fitting new pistons and rings.

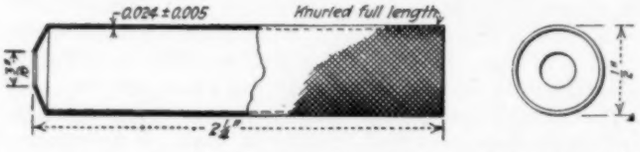
It is not customary to alter the position of piston-pin holes in order to make up for the lower compression due to enlarging the cylinder bores, since the difference in compression is practically negligible.

Q. We have three cast-iron rollers that we are refinishing. They are for an ink mill for grinding printers' ink. The rollers must have a smooth finish and we want to harden the surface by some process that will make them less liable to be dented by grit or other substances that may get between them. Do you know of a process that will do this? The rollers are 8 in. in diameter and 22 in. in length.

A. The rollers can be slightly surface-hardened by rolling them with a hardened steel roller held in a holder in the toolpost of a lathe. The hardened roller should be about 3 in. in diameter and ¾ in. in width, with the corners well rounded. The work should be plentifully supplied with oil. In addition to hardening the surface of your rollers, the process will give them a good finish, if the surface of the hardened roller has a high polish.

Q. Herewith is a sketch of a soft steel shell. Can you tell me what would be the best method to produce such shells at the rate of 1,000 per day? What machinery would be necessary and what would be the manufacturing cost?

A. The best method of making the shell is to draw it from sheet metal in a press. The operations would



be: cutting the blank from the sheet, and drawing by several stages, with an annealing between stages. The knurling could be done in an ordinary engine lathe with the proper tools.

If the dies were properly made, we believe one press would produce the shells at the rate of 1,000 in ten hours. Note we say at the rate of, which does not mean that at the end of ten hours you would have 1,000 completed shells, because to do this you would have to change the dies in the press as many times during the day as there are drawing operations.

The machinery required would be: One drawing press and the necessary dies. One annealing furnace. One, or possibly two, engine lathes fitted with the necessary tools for knurling.

Manufacturing costs are governed by so many factors that it would not be possible for us to give an estimate without a survey of your plant and equipment.

Technical Abstracts

Methods for Controlling Production

H. S. Riggs of the Lodge & Shipley Machine Tool Co. states that the company builds thirteen different sizes of lathes with ten of them made in two styles. Eighty-nine units and subassemblies are used in assembling the final machine and attachments, and in the average lathe there are 1,000 separate pieces. To simplify manufacture, the various machines are sent through the factory in lots, or runs, as they are called. The size of the run varies with the demand. In busy times, practically every run brought through is sold completely months before the parts are finished, and at such times there is no halt in the procedure, as the lathes are built and shipped out. Any orders coming in after the run is completely sold out must wait to be scheduled in the next.

The works office divides its job into four parts: first, securing the material; second, keeping a perpetual check of material on hand; third, routing, machining, and assembling the material; fourth building the lathes. One of the most important features of the control is the "Master Short Book" which shows the material wanted and not on hand for the work. This is a loose-leaf book and provides the works manager, the purchasing department and the shop tracers with vital information.

When it is determined to build a quantity or run of tailstocks or lathes, each unit is built up into an individual bill of material or parts list, as it is called. Each run is given a number to identify it in its travel through the shop. The engineering department is notified that a run of tailstocks is to be issued and it makes out a parts list in triplicate and sends it to the works office. The parts list consists of a sheet or sheets on which are written the piece and drawing numbers, the name of the parts and the quantity wanted of each, together with blue prints of all the detail parts. With the parts list in an envelope are the blue prints of the work to be done. These are all kept together for ready reference. Each piece has a number, and these piece numbers are the means of identification as to style, size and name. A traveler tag is attached when castings are received from the foundry and accompanies each lot of parts with complete information about the work to be done. Two factors have been considered of prime importance in creating control mechanisms. These are that the system should be simple and contain a minimum amount of "red tape" and consequently should be so planned that its success or failure does not rest upon the activities of one man or a small group of men.

Accompanying this article are a number of diagrams of forms used. —*Management & Administration*, December, p. 643.

Maintenance of Belts

In an article dealing with belts, shafting and hangers, K. D. Hamilton of the George E. Keith Co. gives simple rules to follow in handling belting.

One of the most important rules is to run the single belts so that the points of the laps will run against the pulleys and with the grain or smooth side next to the pulley. Belt dressing consisting of rosin or other sticky material should not be used. Belts should not be run when the shafting or pulleys are out of line; belts should not be run too tight as this causes bearing wear: belts should if possible run with the tight side on the bottom; belts should be kept clean and the edges should be protected and not allowed to ride up on flanges of pulleys, or against belt shifters.

Heavy belts should never be run over small pulleys and a high grade leather belt should not come into contact with moisture; heavy or bulky belt fasteners should be avoided when possible and high speed belts should be of uniform thickness throughout the entire length. Belts should not be run overloaded as this brings about continuous breaking down.—*Factory*, December, p. 790.

Estimating Contract Work

Dale S. Cole of the Leece-Neville Co. of Cleveland shows how contract work is differentiated from the jobbing business in that it involves some degree of quantity production, and it is not the day-to-day pickup, hit and miss work commonly classed as "jobbing." Contracts are usually placed by large manufacturing concerns, who are not equipped for the work contracted for, and whose facilities are not great enough to meet their demands. Contracts are also placed by selling organizations that do not wish to assume the manufacturing end of their business. In this work the executive of the organization is confronted with the problem of costs, not only his own, but also those of his competitors. A shop operating on contract must forego some of the profit to be derived from the sale of the article and is relieved of some overhead expense that goes with it. There is keen competition for this work, and it will usually be found that labor and material costs will not vary greatly for shops of similar equipment. This leads up therefore to the consideration of just how much the overhead may be pruned in order to arrive at a competent figure. For some reason or other overhead costs are often regarded with an air of mystery and when brought out to public view they often seem to embarrass the bidder. Overhead should be regarded as a flexible cost depending greatly on the amount of work that is being done in the plant. Some specific examples are given and in one the overhead per hour corresponding to a total per month of 5,000 hours is $1.40 per hour. At 11,000 hours, the overhead drops to $0.70 per hour. This point is often either not appreciated or lost sight of, as far too many firms establish a fixed overhead rate.

The article concludes with the statement that in general the bidder who has intimate and first hand knowledge of his costs, and data accurate and easy to use, has a great advantage over the bidder who "fumbles in the dark."—*Industrial Management*, December, p. 373.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

What's Ahead?

AT THIS season of good resolutions the average man is wondering what the year ahead holds in store for him. As he is usually pretty well satisfied that his own actions are all for the best he must attribute his disappointments, if any overtake him, to adverse "general conditions."

It has grown to be a habit, along about the end of the year, for prominent business men and industrialists to hazard opinions on what business will be like during the ensuing year. Some of these opinions have been grouped to form the leading article in this issue. It is worth while to note that they are all optimistic although some are somewhat guarded. What are the reasons?

First of all comes the financial situation. We are in a period of easy money, the Federal Reserve System seems to be functioning well as a sufficiently flexible currency accumulator, if it is permissible to compare currency with hydraulic pressure. The reserve ratio is still at a high level. The turn in the tide of inflowing gold has come and the gold situation in January, 1925, is little different from what it was in January, 1924. In other words, no gold has been added to our already large supply during the last year. What has come in from abroad has been largely absorbed in foreign loans and more will be taken up by industrial expansion in the next few weeks.

Prices of farm products are high and the farmers in most parts of the country have gone far toward a clearing up of their old debts. As a result they are no longer forced to postpone equipment purchases and industry will be proportionately stimulated.

The railroads are better off than they have been in some time and may be expected to make a fair start during the year toward the long-deferred rejuvenation of their repair shops. With the prospect of little railroad legislation, and the unlikelihood of any that will be adverse, the railroad managements can relax some of their vigilance in defense of their properties and devote more constructive effort to their maintenance and improvement.

A good many people are going to buy automobiles this year. Engineering improvements are constantly coming to light as new models appear, some of which are so far superior to their predecessors of a year or two ago that the man who wants the best in automobile value for his dollar will be forced to dispose of the older models in favor of the new. There is little likelihood of the establishment of any new production or sales record totals for the year but there is no reason to believe that the totals will fall much below those of the last two years. And certainly it has been evident that the majority of the car manufacturers can make money on the volume of business they have enjoyed. Some of the weak ones will undoubtedly be forced out as is the case in any industry when it reaches the competitive stage in which the automobile industry now finds itself. Automobile shop practice is generally of a high order but there are still many shops where obsolete and worn-out tools can be found. As they are replaced, profit margins should rise.

Conditions abroad are affected by many factors with which we in America are unfamiliar and over which we have no control. But the working out of the Dawes Plan holds out golden hopes for the future and when all is said and done the only thing that American manufacturers of machinery should really expect is something like a parity in production costs in other countries as compared to those here. Our labor costs are still higher than those in the countries where competing machines are built but the disparity is diminishing steadily and our chances for foreign business are improving correspondingly.

That American industry has not forgotten what happened in the inflation days following the war is evident from the many warnings of the dangers of inflation that are even now being sounded. As a matter of fact, there can be no inflation of a serious nature until virtually all of industry is running at full capacity. When that time comes and speculation prepares to take a hand in the game, we may begin to take measures of precaution.

For the present, then, we can turn our attention to digging for business and can look ahead with the confidence that a constructively conservative administration in Washington, backed by the great majority of the American people, is on the job to help industry and not hinder it.

Shop Equipment News

Milwaukee Motor-in-Base Milling Machine

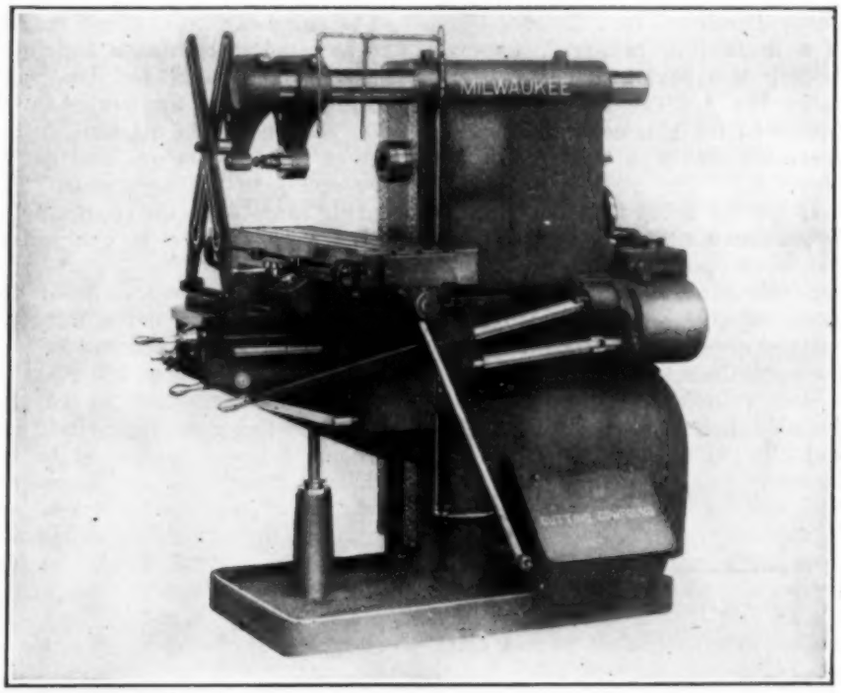
The Kearney & Trecker Corp., Milwaukee, Wis., is now marketing its line of milling machines arranged for motor driving and with motor mounted in the base. This location of the motor utilizes the space in the lower part of the column and keeps the motor out of the way. The motor is also protected from dust and dirt, and the entire installation is made quiet, compact and economical.

The company has adhered to the use of the direct geared connection between the motor and the machine, no belts or chains being used. The driving pinion is mounted on the armature shaft and meshes directly with the gear that drives the gear train in the column. The motor is placed with the driving pinion toward the front of the machine, as in this position the commutator and brushes can be reached by simply removing the hinged cover at the rear of the machine. Fig. 2 illustrates the arrangement at the rear of the machine.

The entire motor can be slid out of its housing if any major adjustments or repairs are necessary. Ample provision for the lubrication of the motor is made and the lubrication system can be attended to from outside the machine. Ventilation is obtained through the use of properly-placed louvers, and it is stated that no overheating of the motor has been observed under most severe test conditions.

Other refinements on this machine include an improved design of friction clutch and a built-in power rapid traverse for the table. The control lever for the clutch is extended to a convenient position at the front of the machine, and may be adjusted at any angle desired by the operator. It may also be swung completely out of the way to accommodate very large work.

A lever at the front of the table engages the power feed in a direction determined by the lever movement. A second lever, conveniently located at the right hand of the operator as he stands in the normal operating position, may be shifted to cause the table to move at the feed or rapid traverse rate, as desired. The levers are entirely separate and the movements are not easily confused. Other levers controlling the engagement of cross and vertical



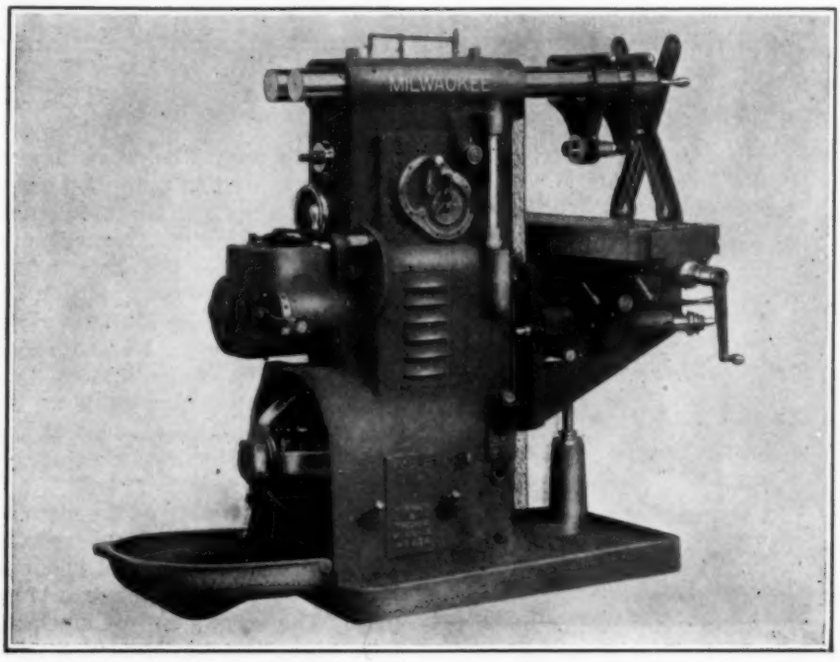


Fig. 1 (above)—Milwaukee Motor-in-Base Milling Machine

Fig. 2 (left)—Rear view of Milwaukee miller showing motor location

SHOP EQUIPMENT NEWS

feeds are conveniently located and entirely separate from the table control levers.

The machine embodies the usual features of the milling machines manufactured by this company, including the all-geared drive, automatic lubrication of the column gearing, double over-arm, etc. It is furnished in eight sizes, the friction clutch being standard on all models and the power rapid traverse on all except the Nos. 2AS and 2BS machines.

Baker Two-Way Horizontal Automatic Drilling Machine

A recent addition to the line of drilling equipment manufactured by Baker Brothers, Inc., Toledo, Ohio, is a horizontal, cam-feed, two-way drilling and boring machine, designated No. 3. The machine can be furnished for single-spindle opposed operation or in a multiple-spindle type.

It will be noted that the machine is composed of three main sections, the outer portions containing the opposed spindles and their driving mechanisms. The center section supports the work and is built to suit the operations to be done.

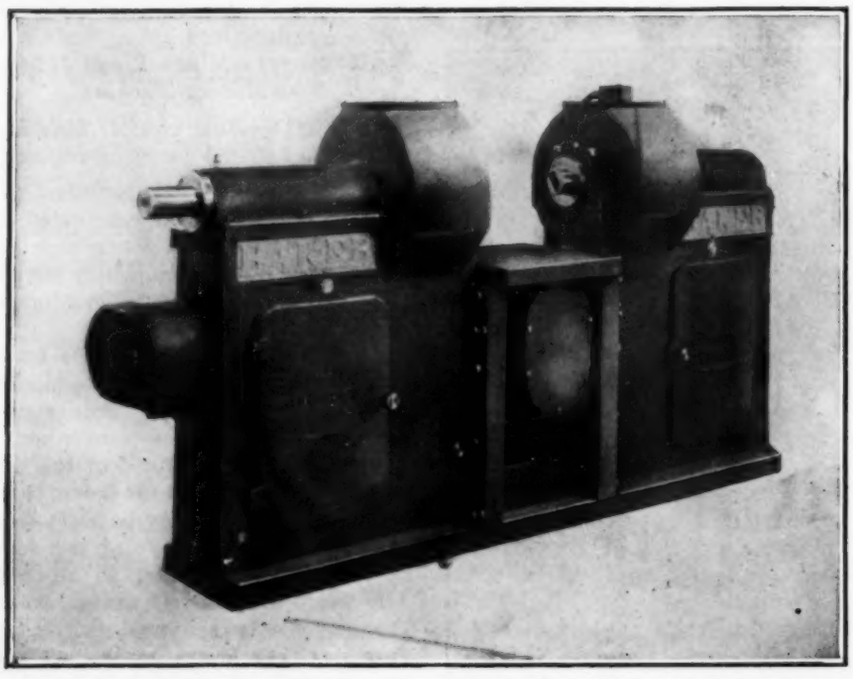
Both spindles are mounted in adjustable bronze bearings at either end. The spindle noses have a No. 4 Morse taper and special driving slots. The feeding motion for the spindles is derived from flat cams, by which a rapid approach, feed and quick return are obtained. The timing of the automatic actions of the spindles in relation to each other is determined by the requirements of the work.

The cams can be changed readily and are said to be simple and inexpensive. The cams and the other feeding mechanism are located in the outer sections of the machine, in the base of which doors are provided to give access to the apparatus. The gearing is suited to the requirements of the work and can be changed at any time, if desired.

The machine can be fitted for either belt or motor drive, although the motor drive is recommended. A 5-hp. motor running at 750 r.p.m. is required. The motor is coupled directly to the main drive shaft and a solenoid brake is applied to the armature shaft to obtain immediate stopping of the spindle when the cycle of operation is completed. Push-button control can also be furnished and is located conveniently for the operator.

When work requiring the use of cutting lubricant is to be done, the necessary pump, tank and fittings can be supplied. The dimensions of the machine depend to a considerable extent on the requirements of the work. The maximum length of travel for each spindle is 6 in. on the standard machine. The distance from the center of the spindle to the work table is 8 in., the maximum distance between the ends of the spindles in the withdrawn position being 16 inches.

The floor space required by the standard machine is 40x96 in. and its weight, including the motor, is 4,200 pounds.

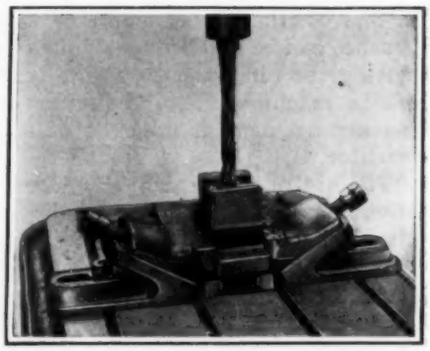


Baker Two-Way Horizontal Automatic Drilling Machine

Coats Divided Machine Vises

The Coats Machine Tool Co., Inc., 108 West 40th St., New York, N. Y., is putting on the market a line of divided machine vises for holding parallel, tapered or irregular pieces.

The vises are adjustable in height, have a downward thrust of the jaws,



Coats Divided Machine Vises

tending to apply the work against its supports, and an unlimited length of span. They can be used either singly or in multiple for clamping irregular shapes. The jaws may be placed in any off-set position required by the shape of the work.

While these vises find numerous applications in the tool room, their main field of usefulness is in the shop, mounted on the tables of milling, drilling, shaping, slotting and planing machines.

The body and jaws of the vises are made of cast iron. The jaws are faced with hardened steel and have serrated surfaces to ensure a better grip. The screws are of steel, and have right and left-handed threads,

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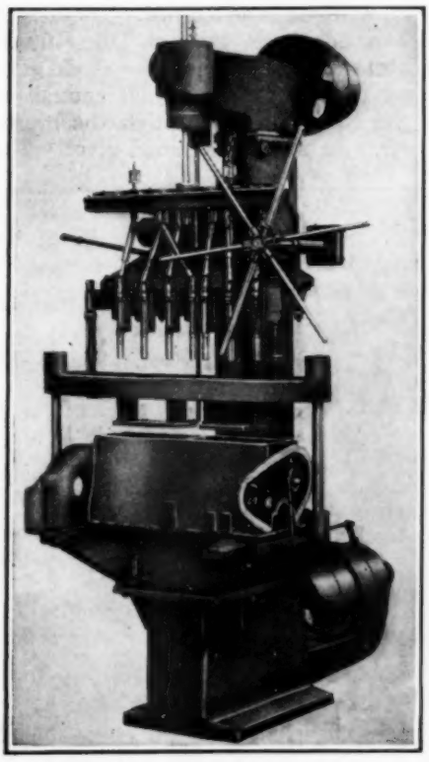
the left-hand thread running in a solid nut on the moving jaw, and the right-hand in a nut which is secured to the body. For each revolution of the screw, therefore, a movement of the jaws is obtained equal to twice the pitch of the screw. The jaw is fitted in V-guides, and an adjustable steel gib and screws furnish the necessary adjustment for wear. A pin wrench, for operating the jaws, is supplied with the vises. The parts are interchangeable.

Three sizes are manufactured at present, corresponding to the following widths of jaws: 2½ in., 5 in. and 10 in. The corresponding weights per pair are: 6 lb., 40 lb. and 220 lb. The largest size of vises have two slots, provided with a cross-plate to suit tables with varying distances between centers of slots.

Fox No. 12 "Rail-Type" Multiple Drilling Machine

A multiple drilling machine of the so called "rail-type" has been brought out by the Fox Machine Co., Jackson, Mich. The work for which it was originally designed was the drilling of the crank case for a six-cylinder automobile engine. Seven holes in a straight line have to be drilled and the head carries a corresponding jig plate.



Fox No. 12 "Rail-Type" Multiple Drilling Machine

The base of the machine is of special design, the front part being lower, to allow the base of the holding fixture with its two vertical parts to serve as guides for the bushing plate.

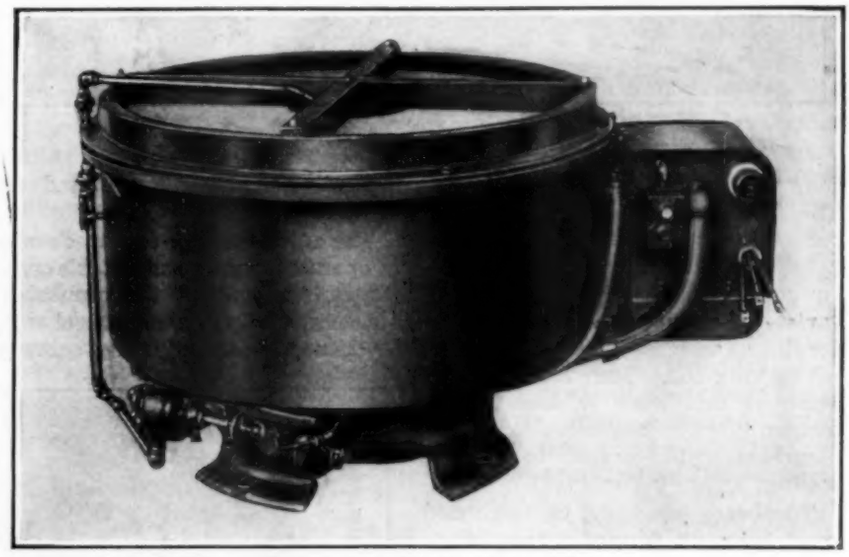
The drill spindles are carried in a 30-in. head of the rail type with four clusters, bored for twelve spindles. The seven spindles shown are 1⅛ in. in diameter, with arms ground to fit the tongue on the rail head. They are adjusted horizontally in a straight line, and vertically each spindle is adjusted in its own bearing.

The spindle speeds are 424, 616, and 894 r.p.m., and the feeds are 0.0025, 0.0041, and 0.0068 in. per revolution of spindle.

The working surface of the table is 16x21½ in. The net weight of the machine is 2,730 pounds.

Besly No. 39 Vertical Grinder

Charles H. Besly and Co., 118 North Clinton St., Chicago, Ill., has placed on the market a 42-in. vertical-spindle motor-driven grinder known as No. 39. The machine, as shown in the illustration, is for wet grinding and has a motor-driven pump and an automatic starter with a start-and-stop push-button station.



Besly No. 39 Vertical Grinder

The motor, of 20 hp., 575 r.p.m., is built into the base of the machine. It has two radial ball bearings and a ball thrust bearing. All ball bearings are mounted in inserted renewable bushings.

The top radial ball bearing is oiled by means of thin oil forced up and through it by means of a vein which revolves with the spindle in the bearing sleeve. The bottom radial bearing and thrust bearing run immersed in oil. Suitable fittings are brought to the outside of the machine base for filling or draining the oil from the bearing sleeves.

The tank, which contains the coolant, forms an integral part of the motor-head casting. It completely surrounds the motor, thus affording protection from dirt or water. There are three clean-out holes in the bottom of the tank with water-tight hand-hole plates.

A removable guard ring is provided around the disk wheel, projecting 2 in. above the grinding face. This prevents the work from flying off the wheel while being ground and also directs the grindings and coolant into the tank below. Cross-bars are attached to the top of the guard ring to prevent the work from revolving with the wheel.

The operating floor space is 8x8 ft., and the net weight 3,140 pounds.

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Ajax Continuous Motion Bolt and Rivet Heading Machine

The Ajax Manufacturing Co., Cleveland, Ohio, has recently put on the market an addition to its line of bolt and rivet making machinery which may be either hand- or automatic-feed, belt- or motor-driven, as illustrated in Figs. 1 and 2. The

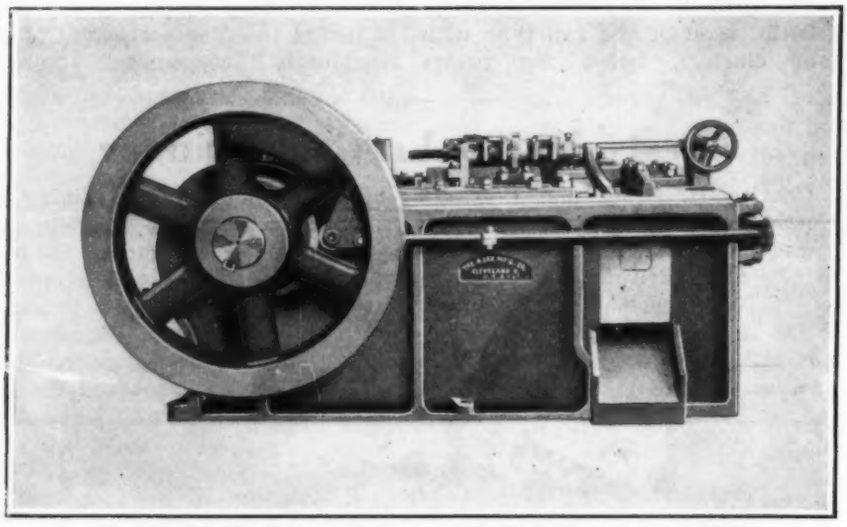

Fig. 1—Hand-Feed, Belt-Driven, Ajax Heading Machine

four sizes are ¾, 1, 1¼ and 1½ in. These machines are used principally for hot-heading rivets, carriage bolts, track bolts and machine bolts. In addition they produce quite a variety of special bolts and one-blow forgings, such as automobile rim-bolts, king-bolts and valve-tappets. Much of this work is done at low temperatures, commonly termed "semi-hot," in order to reduce scaling.

The heads of rivets, carriage and track bolts are formed without flash and do not require trimming. In filling out the corners of square and hex-head machine bolts, however, a washer-shaped flash is thrown out around the bottom of the head, which is afterwards trimmed off cold in a vertical trimming press.

With the hand-feed machine, Fig. 1, rods heated to four or five feet in length are fed into the machine against the stock gage by the operator by hand, the machine shearing off a blank, heading and ejecting it. Outputs range from 14,000 to 18,000 counts per ten hours.

With the automatic roll-feed machine, Fig. 2, rods are heated in a long furnace, set about three feet from the front of the machine. The operator starts the rod into the rolls, which feed it into the machine so that a piece is produced on each revolution. Outputs vary from 30,000 to 50,000 units in ten hours, depending on the length and size of rivets produced.

The automatic roll-feed mechanism is operated from an adjustable crank-pin at the end of the crankshaft. The eccentricity of the pin is changed by means of an adjusting screw so that the rolls feed the correct amount of stock to produce any given length bolt or rivet.

The gears of this mechanism are enclosed in the feed housing. The ratchet arm is fitted with two dogs, staggered to give refinement of feed. The feedrolls that carry the heated bar stock consist of rings with the circumference grooved to suit the various sizes of stock. They are mounted in holders on the rollshafts so as to be easily changed for different sizes of stock and adjusted laterally for different shear-center distances. The roll pressure is controlled by removable weights mounted on the bearings of the upper rollshafts which are movable vertically. If necessary the feed can be stopped and locked out by depressing the foot pedal. An adjustment of the distance between the feedrolls and the backing plate will reduce the waste from crop ends to a minimum.

In a hand-feed machine it is possible to attach an automatic roll-feed mechanism at any time as finished pads on the front of the machine are provided for this purpose.

Both hand and automatic-feed machines operate on the same principles so far as the heading mechanism is concerned. The heated bar advances through the breast plate until it strikes the stock gage which is set so that just enough of the bar projects through the breast plate to make a finished rivet. The

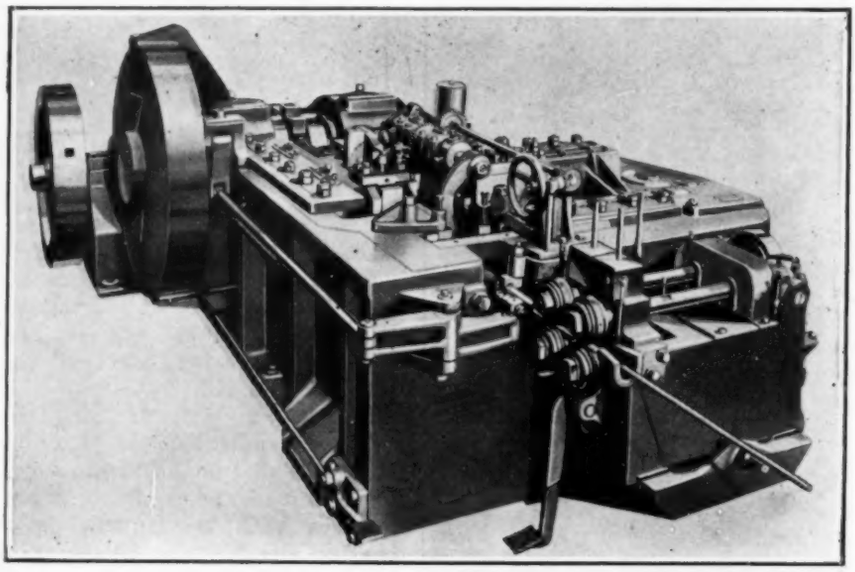

Fig. 2—Automatic Roll-Feed, Motor-Driven, Ajax Continuous Motion Bolt and Rivet Heading Machine

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moving die then travels across the breast plate shearing off the blank on the cutter, and gripping it against the stationary die.

The header-slide moves forward, a cam on top swings the stock gage out of the way and the heading tool in the toolholder heads the stock which projects from the dies against the face of the dies. The heading tool then backs off and the dies open, whereupon the headed piece is kicked out of the dies by the ejector and drops out through the discharge port, completing the cycle.

Water from overhead pipes is directed on the dies and the heading tool to keep them cool and carry away scale.

The power of the motor required is from 7½ to 20 hp. for machine sizes varying from ¾ to 1¼ in. in the case of hand feed, and from 10 to 30 hp. for the same sizes in the case of automatic-feed.

The weight of the machine varies, according to size and type of drive, from 15,000 to 46,000 pounds.

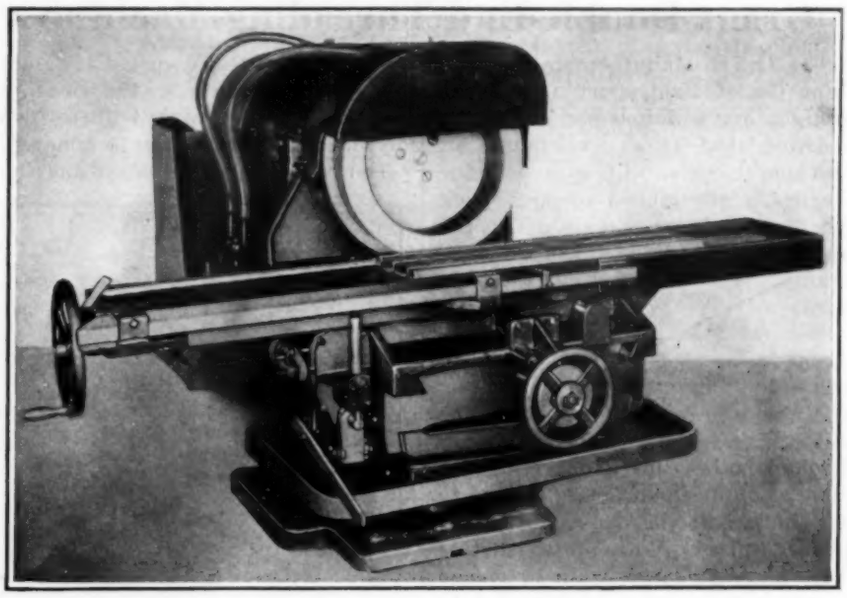
Badger No. 8 Surface Grinder

The Badger Tool Co., Beloit, Wis., has added to its line by developing the No. 8 grinder for finishing flat surfaces. The table top is 73 in. long by 13 in. wide with a finished working top 32x10 in. It has a longitudinal travel of 34 in. and in-feed of 5 in.

The table is driven through nut and screw. The screw automatically reverses when the control handle makes contacts with either of the adjustable stops. The table speed is 3 ft. per minute. In case a table speed of 15 ft. per minute is desired, a rack and pinon are employed instead of screw and nut.

The table can also be arranged to operate by hand, instead of power, using the regular spider handwheel. There is no vertical adjustment to the face grinding table, but holding fixtures of the proper height have to be used. In power-operated tables either a separate motor or a belt drive from countershaft is used. The machine carries two 20-in. abrasive ring wheels.

The far end of the machine is equipped with a regular lever-feed work table of the oscillating type, and is enclosed by water guards. The lever table can also be furnished in either hand-operated or power-operated types.

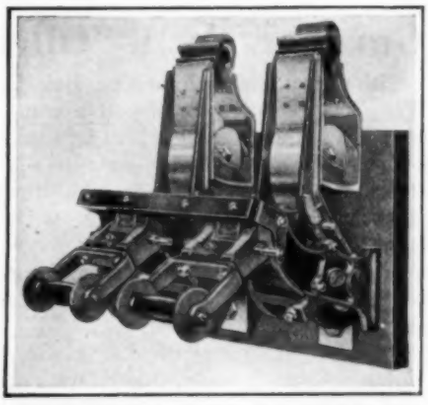


Badger No. 8 Surface Grinder

The machine can be arranged for dry or wet grinding. The complete weight including water pans and countershaft is 5000 pounds.

Roller-Smith Circuit Breakers

Announcement is made by the Roller-Smith Company, 233 Broadway, New York City, of two electric circuit breakers. The first one, shown in the illustration, is known as the double pole interlocked-trip breaker. It is so designed that the two poles are closed independently and successively. If an overload exists, the first pole closed will open as soon as the second pole is closed. If the overload occurs when both poles are closed, they will open simultaneously. This breaker is used on motor and feeder circuits in place of switches and fuses.



Roller-Smith Circuit Breaker

The other circuit breaker announced is called the shock-proof circuit breaker and is recommended by the manufacturer for installations where there is apt to be excessive mechanical vibration. The shock-proof attachment included in this breaker can be supplied for any of the "Standard" type circuit breakers built by the company.

Both of the breakers described are built in seven standard sizes to carry from 5 to 3000 amperes. Larger breakers can be supplied as specials.

Union Twist Drill Co. Ground Drills

Ground carbon steel drills in wire and small jobbers' sizes have recently been placed on the market by the Union Twist Drill Co., Athol, Mass. The drills are ground all over in special appliances used in connection with centerless grinders. A special steel for drills of this type has also been developed.

It is claimed for the ground small drill that the grinding operation cuts under and removes the carbonized surface apt to occur on the drill rod, which, if it comes to the point of the drill, results in rapid dulling.

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Grant Double-End Threading Machine

The Grant Manufacturing & Machine Co. of Bridgeport, Conn., has brought out a double-end threading machine that is a development of previous models. In this machine the heads are gibbed to slide upon the machined upper surface of the bed and the spindles are confined against relative lengthwise movement.

The machine is driven by silent chain from a motor suspended beneath the oil-pan of the sub-base. The main drive shaft extends the whole length of the bed, passing through both heads and driving the spindles by means of gears splined to the shaft. At the end opposite the driving sprocket is a pinion that is the first of a change train by means of which the machine is adapted to cut threads of different pitches.

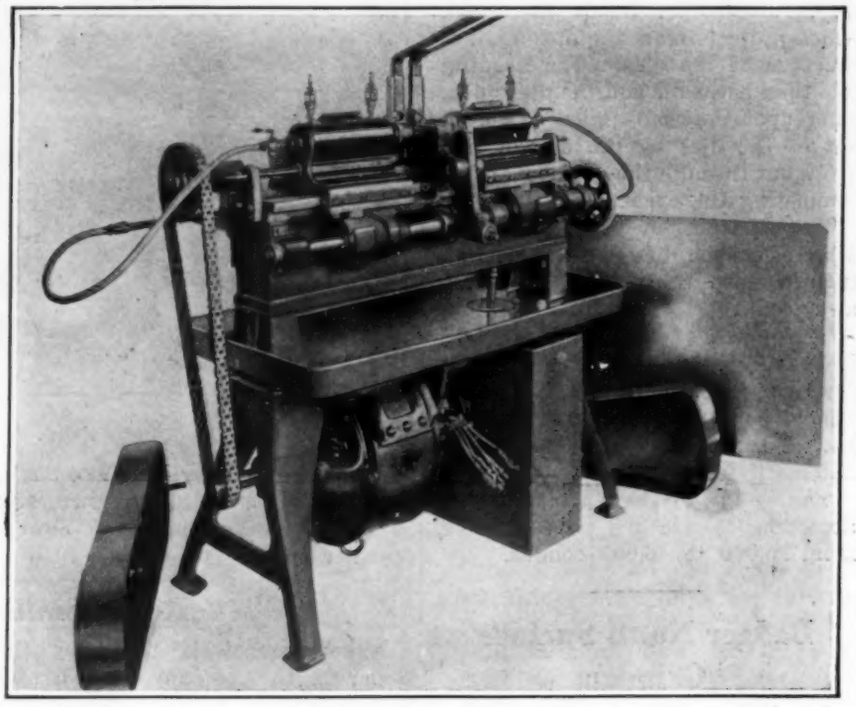
The change gear train drives a camshaft that extends along the front of the bed and carries barrel cams to actuate the sliding movement of the heads. Midway of this shaft is a radial cam to operate the automatic feeding and gripping movement.

Standard H & G self-opening dieheads are used to cut the threads. The change gearing is so calculated in conjunction with the rise of the barrel cams as to advance the heads at the same rate as the lead of the threads being cut, and thus relieve the dies of the duty of dragging the heads. The dies are held to the spindles by spring-supported floating couplings in order to compensate for a slight possible variation between the lead of the dies and the rate of advance of the heads.

Oil is delivered to the dies through the hollow spindles by means of a geared pump, driven by a chain from the main shaft. Suitable covers prevent undue splashing of the oil. A removable receptacle beneath the oil pan provides sufficient capacity for the oil and acts as a settling basin.

The work is automatically fed from a magazine above the center of the machine and the operator is relieved of the necessity for attention to anything but to keep the magazine filled. The final gear of the change train is mounted on an independent sleeve that is connected to the camshaft by a spring-loaded detent so that in the event of a die failing to "catch the thread" or of a piece becoming jammed in the feeding mechanism the gears will revolve idly until the obstruction is removed.

The camshaft is threaded and the barrel cams are retained in endwise position between threaded collars, so that adjustments are easily made to accommodate different lengths of work to be threaded. The capacity of the machine covers the threading of round pieces up to ¾ in. in diameter and from 2 to 8 in. long. Pieces shorter than 2 in. cannot be handled because of the necessity for a clear space between the dies for the feeding and gripping mechanism.



Grant Double-End Threading Machine

The machine is shown with the chain and gear guards removed. It weighs approximately 900 lb. and occupies a floor space of 26x48 inches.

Gardner No. 1 "Oilgear" Surface Grinder

The Gardner Machine Co., Beloit, Wis., has recently developed a combination surface and disk grinder, known as the "No. 1 'Oilgear' Surface Grinder." The right-hand end of the machine serves particularly with large work where heavy cuts are required, especially in the case of long parts, difficult to handle on disk grinders.

The left-hand end of the grinder, which is regularly equipped with a steel disk wheel and universal lever-feed table, is adapted to those jobs that may be performed upon single-end disk grinders.

An important feature of this machine is the hydraulic feed used in effecting the longitudinal travel of the surface table. The control of table travel is regulated through a lever at the front of the machine to suit the job being ground.

The surface table is operated by a double-acting hydraulic cylinder mounted on the compound slide, and directly connected to the table itself. Oil pressure is supplied to the cylinder by a variable-delivery pump mounted inside the base and driven direct from the machine spindle by means of felts. Connection is made to the cylinder from the oil pump by means of flexible hose. All heavy bearing loads are taken on ball and roller bearings and the whole mechanism runs in oil.

The surface table is a one-piece casting with three T-slots. The top of the table is provided with a drain

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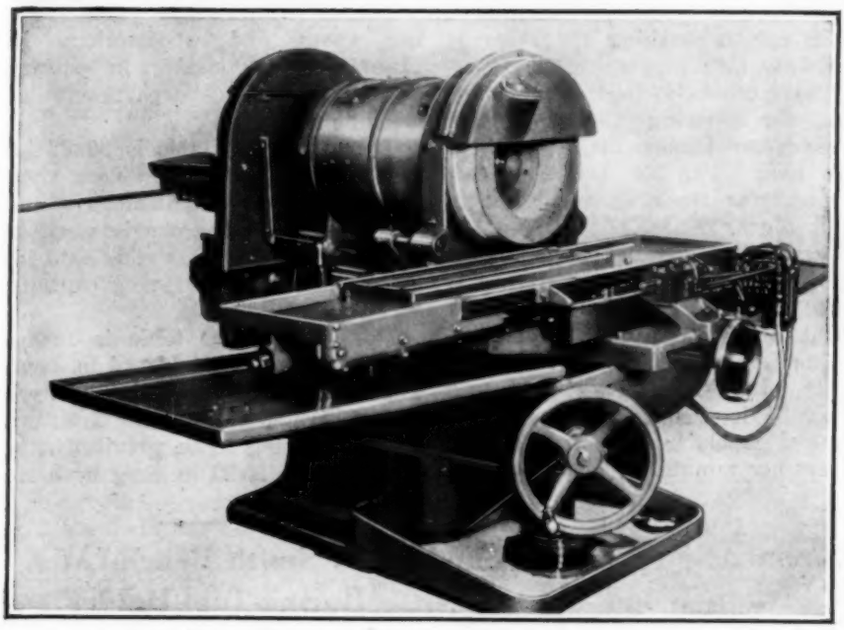


Gardner No. 1 "Oilgear" Surface Grinder

for the coolant to return to the tank at the rear of the machine. The table is mounted on a compound slide. The longitudinal movement is controlled by means of stops placed in a T-slot on the side of the table, which come in contact with the pivot valve, reversing the travel.

The feed of the work to the grinding wheel is obtained through a hand-operated micrometer screw. The compound slide is supported by a knee which is adjustable vertically.

The bottom of the machine base forms a basin for the coolant used in wet grinding.

Poole Engineering Reduction-Gears Types "H" and "K"

The Poole Engineering and Machine Co., Baltimore, Md., has recently added to its line of reduction gears by bringing out types "H" and "K."

The type-H reduction gear, shown in Fig. 1, consists of a double-helical or herringbone gear made from a steel forging, and a herringbone pinion of chrome-vanadium steel, forming an integral part of the high-speed shaft. Both gear members are heat-treated, ground and tested for static balance before being assembled in the cast-iron gear casing in which they are totally inclosed.

The bearings are removable and consist of cast-iron babbitt-lined shells, supported in bosses integral with the top and bottom halves of the casting.

For low-speed drives lubrication is obtained by a splash and gravity system in which the gear dips into the oil and carries it to a reservoir in the upper casing from which it feeds to all bearings and between the teeth of the gears at the line of contact.

For turbines and other high-speed drives, an oil-pump and cooler provide cool oil under pressure to the bearings and gear teeth.

The type-K reduction gear, illustrated in Fig. 2, consists of a herringbone forged-steel pinion, integral with the high-speed shaft, and a cast-steel double-helical spur gear. Both gear and pinion have cut steel teeth.

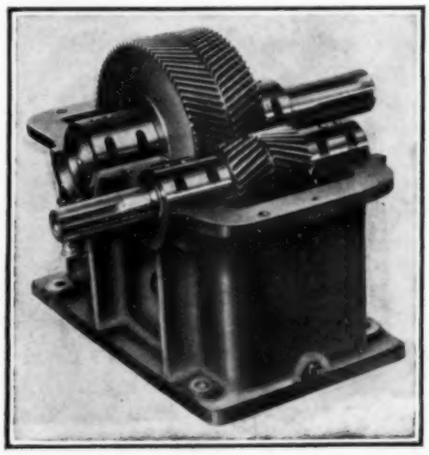


Fig. 1—Poole Engineering Reduction-Gear, Type "H"

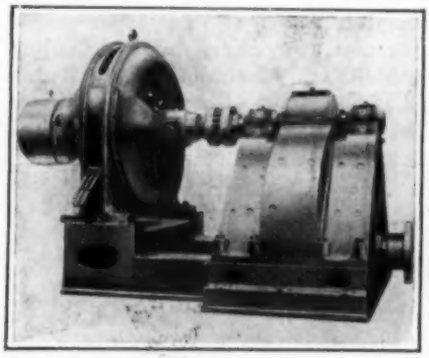


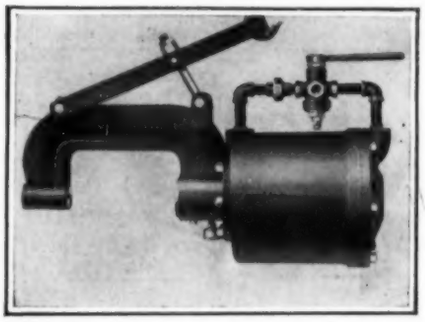
Fig. 2—Poole Engineering Reduction-Gear, Type "K"

The shafts are mounted on babbitted bearings of the ring-oiling type and the gear and pinion are lubricated by the splash system.

The high-speed shaft in the type-K reduction gear is located in the top of the casing and the driven shaft is directly under it near the floor line.

Hanna Straight-Acting Press

A recent addition to the line of riveting machines and similar equipment manufactured by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., is the straight-acting press shown in the accompanying illustration.



Hanna Straight-Acting Press

The machine has a reach of 4 in. and a 6-in. gap. The diameter of the cylinder is 12¼ in. and it is capable of exerting a pressure of five tons at the dies with air pressure at 100 lb. per sq.in. The die stroke is 2 in. and the machine has sufficient capacity to drive ⅞-in. cold or ¾-in. hot rivets. The net weight is 225 pounds.

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Coulter & McKenzie Rotary Swaging Machine

A rotary swaging machine for shaping square and flat taper points has been announced by the Coulter & McKenzie Machine Co., 771 Water St., Bridgeport, Conn. Almost any shape of stock bar can be swaged

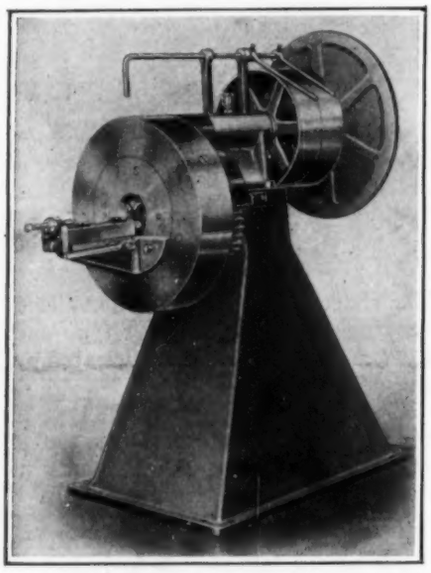

Fig. 1—Coulter & McKenzie Rotary Swaging Machine

but the resulting swaged section will be rectangular, either square or flat.

A general view of the machine is given in Fig 1 and a diagram of the swaging mechanism in Fig 2. The action is unlike that of the usual

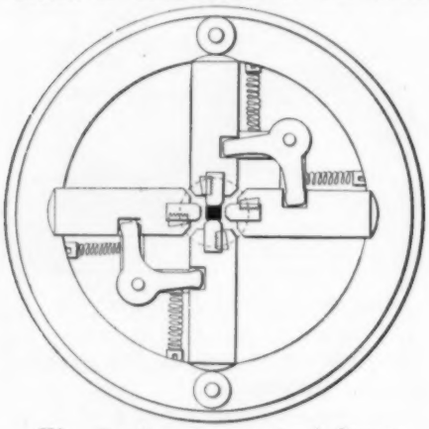

Fig. 2—Arrangement of Swaging Dies

rotary swaging machine in that the dies do not revolve but are actuated by rollers carried on a rotating outer sleeve. As will be seen in Fig. 2, adjacent die slides are connected by spring balanced bellcranks so that when one is working the other is withdrawn to prevent interference.

The machine is particularly suitable for forming file tangs and screwdriver blanks. It is made in two sizes. The No. 1 machine accommodates stock up to $\frac{5}{16}$ in. in diameter or $\frac{5}{16}$ in. square and the longest possible taper in one operation is $2\frac{1}{2}$ in. Shipping weight is 2,000 lb. and a production rate of about 15 pieces per min. is claimed.

The larger machine, No. 2, takes up to $\frac{1}{2}$-in. stock and will produce a taper $3\frac{1}{2}$ in. long. It weighs 3,000 lb. and is claimed to turn out 10 pieces per minute.

Tannewitz "Type E" Combination Wood Worker

The Tannewitz Works, Grand Rapids, Mich., has recently put on the market a portable combination wood-working machine known as "Type E."

This machine consists of a tilting-table saw bench with a 6-in. jointer mounted on the side which can be started or stopped at will, a 2-hp. motor mounted on the back, and a three-wheel ball-bearing truck underneath.

The machine, while primarily intended for contractors, manual training shops and woodworkers in general, is serviceable in pattern shops and crating departments of machine shops.

The saw bench table is 30x36 in. long and $34\frac{1}{2}$ in. from the floor when a truck is used. The diameter of the maximum saw that can be used is 15 in. Dado heads as wide as 3 in. can be used. The ripping capacity is a 17-in. width.

The rear jointer table is 18 in. long and the front table 14 in. long. The width is 8 in. The jointer knives are of high-speed steel and are 6 in. long. A tilting fence, provided with the machine, is 22 in. long by 4 in. high.

Tannewitz "Type E" Combination Wood Worker

J. F. Smith Bench-Lathe Boring-Tool Holder

The J. F. Smith Tool Co., Dayton, Ohio, is placing on the market a bench-lathe boring-tool holder which is made to hold $\frac{1}{4}$-in. bars of any length and can be adjusted to different heights.

The boring-tool holder is made with an offset turned on the end of the shank. Its length is 4 in., and the shank is $\frac{5}{16}$ x $\frac{1}{2}$ in. The offset is knurled with a straight knurl and has a large fillet.

The clamp which fits over the offset and holds the boring tool is

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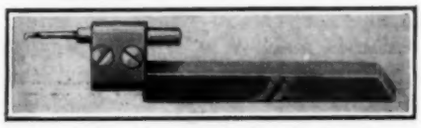
countersunk on the shank side to clear the fillet. This clamp is made in two parts with screws binding in the center. When tightened, these screws draw the clamp down into the straight knurl on the shank,



Boring-Tool Holder

preventing slipping, and bind the boring tool.

It is claimed that with the use of this toolholder an operator is enabled to keep his bar on center and parallel with the hole being bored, thereby permitting the use of boring bars of larger diameter than would be possible with a non-adjustable toolholder.

Tycos Thermopyres

The Taylor Instrument Co., Rochester, N. Y., has recently added to its line and is now marketing a high-temperature portable pyrometer under the name of "Tycos Thermopyre."

The pyrometer consists of a 39-in. thermocouple stem, combined with a millivoltmeter, having a scale-range of 2,200 deg. F. The indicator is enclosed in a cast-aluminum case with a hardwood handle to which a ring is attached for the purpose of hanging the instrument when not in use.

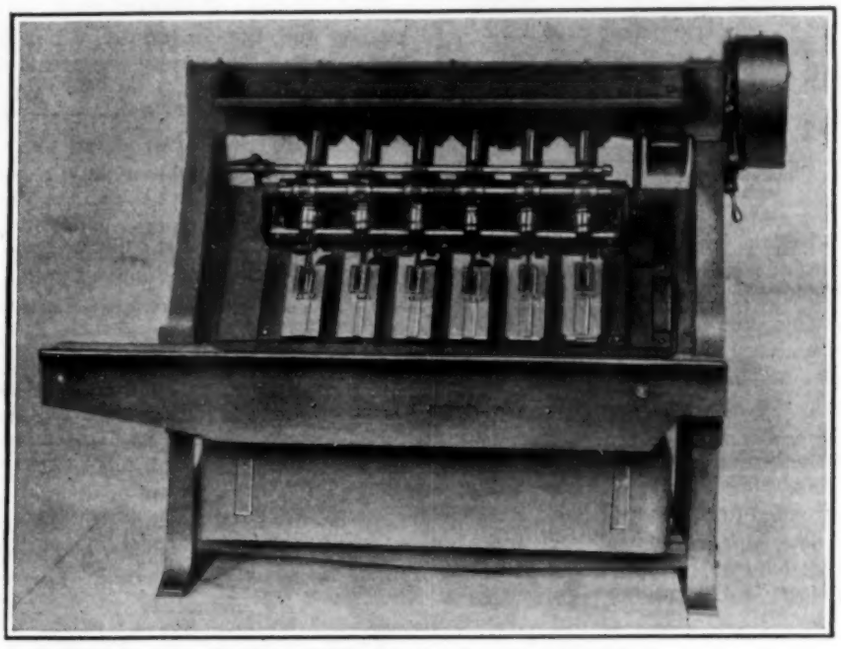
The instrument has an accuracy of 20 deg. F., corresponding to one division of the scale-range of 2,200 deg. F., sufficient for many industrial purposes where only relative accuracy is required.

The pyrometer is of the direct-insertion type and can be used for checking purposes with quick-heating furnaces, muffles, checkers, stacks, kilns, back passes, flues, galvanizing kettles, aluminum melting pots, ovens and in similar cases, where only occasional checks at relative temperatures within the scale range are desired, but not for continuous duty on permanent installations.

The instrument can, if desired, have a Centigrade scale up to 1,200 degrees, instead of the Fahrenheit scale up to 2,200 degrees.

Holmes Tilted Bolt Threader No. 20

The Holmes Engineering Co., Oshkosh, Wis., has developed, assisted by the Graham Bolt and Nut Co., Pittsburgh, Pa., a bolt threading machine designed for bolts up to ⅝ in. in diamenter and from 1 to 12 in. long. The operator loads and knocks out the bolts, but all the other operations are fully automatic. Several changes of cutting speed are provided.

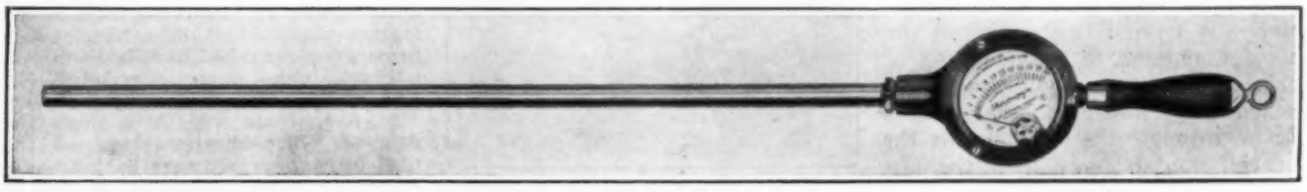


Holmes Tilted Bolt Threader No. 20

The six tilted spindles are placed at an angle of 30 deg. from the vertical to permit the use of self-clamping slots and to facilitate the ejection of threaded bolts into the conveyor and the washing away of chips. Sixty quarts of cutting lubricant flow through the hollow spindles per minute.

Twelve synchronized cams are employed, six to start the bolts and six to close the die-heads. These cams act against counterweights only, and an imperfectly entered bolt cannot break the chaser nor can a clogged die-head be strained. The lower set of counterweights starts the bolts and the upper set closes the die-heads.

It is claimed that a complete change of set-up can be made in ten minutes, and that if the change affects only the length of the bolts, one minute for all six spindles is enough. Threads on the smaller sizes of bolts can be cut at the rate of 60 per minute, and on the larger sizes at the rate of 50 per minute, without undue fatigue to the operator.

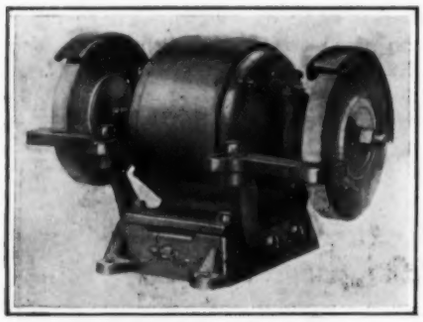


Tycos Thermopyre

SHOP EQUIPMENT NEWS

Azor Bench Grinder

The Azor Motor Manufacturing Co., 7424 Bessemer Ave., Cleveland, Ohio, is marketing the two-wheel, motor-driven, bench grinder shown in the accompanying illustration and intended for garages, tool rooms, machine shops and home-work shops. It is adapted for very light grinding



Azor Bench Grinder

and has a ½-hp., 110-volt motor, running at a speed of 1,800 r.p.m., which can be furnished for direct or alternating current. The motor switch is enclosed in the base. The spindle bearings are claimed to be entirely dust-proof. The machine is equipped with two grinding wheels 6 in. in diameter and ¾ in. wide, removable rests, plug and cord. The shaft is threaded for a Jacobs Chuck, size 2-B.

The dimensions of the machine are: length 13½ in., height 8 in. Its weight is 41 pounds.

"Knorr" Lubricator

The Malcolm H. Smith Co., 50 Congress St., Boston, Mass., has brought out the grease cup, illustrated in Fig. 1, intended for application to any stationary bearing that requires constant and even lubrication, without the possibility of overflow, such as bearings for line-shafting, textile machinery, grinders and similar installations.

The cup is made of a hard aluminum alloy and is provided with a hinged cover and catch. Inside the cup as shown in Fig. 2, there is an elliptical spring, made of flat sping steel and riveted to the wall of the cup. Connected to the free end of this spring is a small brass rod, called the "feed-pin," that passes down through the oil hole in the bearing cup and rests upon the surface of the revolving journal.

The connection of the rod with

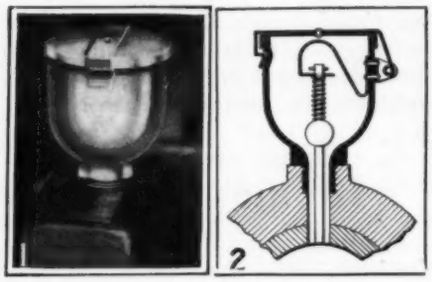


Fig. 1—Knorr Lubricator. Fig. 2—Section of Knorr Lubricator

the steel spring is not rigid, but is made through the medium of a small helical spring of brass that surrounds the upper end of the rod. This spring is under compression when the lubricator is in place.

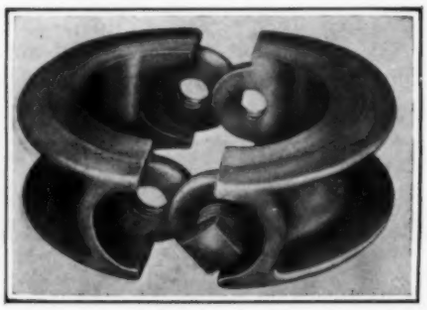
A ball formed from sheet metal is swaged onto the brass rod and serves the double purpose of a collar for the helical spring and to agitate the grease in the cup, thus causing it to flow through the orifice. The agitation is caused by the lower end of the rod riding upon the surface of the journal.

It is claimed for this device that it supplies constant and effective lubrication without waste of the lubricant and that there will be no drip from bearings equipped with it. Any soft cup-grease of good quality may be used. The cup is made in 2-and 3-oz. sizes with ⅛- and ¼-in. pipe thread, respectively.

Link-Belt Malleable-Iron "Split-Type" Safety Collar

The Link-Belt Co., Indianapolis, Ind., has recently added to its line of safety collars and is now marketing, the "split-type" shown in the accompanying illustration.

This device is intended to maintain



Link-Belt "Split-Type" Safety Collar

the proper alignment of such equipment as pulleys, shaft bearings and hangers. Its design makes installation and adjustment easier as the collar is split in two pieces. The set-screw, by which the collar is affixed to the shaft, is flange-protected.

The material of which the safety collar is made was selected because of wear- and rust-resisting qualities, in order to extend its sphere of usefulness to installations where the atmospheric conditions contribute to rust or excessive abrasiveness.

Growing Stability in the German Tool Trade

During the month of October and early November a further revival of business was reported by German tool manufacturers, Trade Commissioner D. P. Miller, Berlin, advises the Department of Commerce. Prices which have been on a low level, in many cases as much as 30 per cent below the pre-war figures, are showing a stiffening tendency, he states. The increased business reported comes mostly from the domestic market and accompanies the improvement in the iron and steel trade.

Increased orders for precision tools are reported from shipbuilding and electrical industries, while the automotive trade and builders of railway rolling stock are coming into the market for highspeed tools, especially drills. On the other hand, business is slack in small machine shops and orders are light from these quarters. There is a general disposition in the trade to pay small attention to export business. It is felt that German tools are unable to be delivered at a good profit abroad, partly on account of the high tariffs against them and the increasing competition from other countries. There is also a feeling that price cuts by German exporters at this time, leading to increased competition, might have the effect of stimulating further tariff restrictions which would react on the German industry in the long run.

Satisfaction is expressed over the growing stability of the trade and closer organization of all producers. During the inflation period a great number of new firms, estimated at 2,000, sprang up, many of which have now disappeared. These newcomers were in many cases entirely ignorant of the tool business and bought half finished goods from other companies, finishing them cheaply and throwing them on the market at all kinds of prices. Older firms were compelled to follow suit and a chaotic price situation resulted. In general the production capacity of German tool plants was three times the demand. The disappearance of the new forms for the most part has resulted in more stable prices and a better feeling in the machinery and machine tool industry.

News of the Week

Wages in the Metal Trade Not Reduced Conference Board Finds

Interesting data collected by industrial association

The absence of wage reductions in the metal trades during 1924 is shown by the stability of hourly earnings according to data collected by the National Industrial Conference Board. What reductions there were in the industry were not sufficient to affect the average. For the industry as a whole hourly earnings stood close to 60 cents during the year and in October stood at 60.4 cents. Weekly earnings shared in the general spurt in February, but after that steadily declined until September, when they showed a slight increased that was followed by a further increase in October. The average weekly earnings for October were $28.09 as compared with $29.24 for October, 1923, and $13.71 for July, 1914. The trend of weekly earnings for each of the industries in the metal group follows the composite trend very closely.

The trend of hours of work followed the trend of weekly earnings; naturally so, as hourly earnings were steady throughout the year. Hours of work registered an increase in September, that was strongly emphasized in October, when the average week stood at 47.1, about two hours lower than in October, 1923.

Employment in the metal group as a whole declined steadily during most of 1924. After August it rose, attaining 69.7 per cent in October.

Agricultural implements and automobiles showed improvement in the early months of 1924 over the closing ones of 1923, but electrical apparatus and foundry and machine shop products remained dormant. Between March and July all four met very unsatisfactory conditions and were forced to reduce their forces. Between July and October agricultural implements had regained 9.4 per cent in employment as against a loss of 30.4 per cent during the first half of the year. Automobiles started with a full working schedule; but after March they dropped rapidly, recovered somewhat in August and, after a drop, again in October, when they had regained 3.9 per cent in employment as against 38.9 per cent loss earlier in the year.

A. S. M. E. Will Sponsor Lock Pin Standards

At the request of the American Engineering Standards Committee the American Society of Mechanical Engineers has accepted sole sponsorship for the standardization of taper pins, straight pins, split pins, dowel pins, plain washers and lock washers. At the present time the sectional committee which is to carry on this work is being organized. All societies, associations and government departments which are known to be interested in this project are being asked to appoint official representatives on the sectional committee.

This subject was brought to the attention of the A. E. S. C. by the Acting Chief of Ordnance of the War Department. It was then referred to a special committee appointed by the chairman of the main committee and in the course of time the special committee made its recommendations to the main committee and sponsorship was offered to the A. S. M. E. and accepted by the Council.

The importance of this subject will be recognized by all those engaged in the manufacture of machines of various kinds and the secretary would be glad to hear from the members of the society who are especially interested. As one of the co-operating associations, the A. S. M. E. will appoint one or more representatives on the sectional committee so the president will welcome any information which will guide him in making these appointments.

Address all replies to C. B. LePage, in care of the society.

Railroad Equipment Installation

Freight cars put in use by Class 1 railroads during the first eleven months of the year totaled 148,831, the November figure being 11,462, according to reports filed recently by the carriers with the Car Service Division of the American Railway Association. The number installed in the eleven months was a decrease of 29,014, compared with the same period in 1923.

Of the total placed in service so far this year, box cars numbered 67,939, coal cars 47,196 and refrigerator cars 12,640. The railroads on Dec. 1 had 45,095 freight cars on order, which included 27,792 box cars, 10,693 coal cars and 3,167 refrigerator cars.

Locomotives placed in service during the first eleven months totaled 1,951, of which 181 were installed during November. Class 1 carriers also had on order on Dec. 1, 265 locomotives, compared with 739 on the same day last year.

The figures on both freight cars and locomotives placed in service include new, rebuilt and leased equipment.

Nash Takes Lafayette Auto Plant

The Nash Motors Co. will increase its capacity at Milwaukee 50 per cent by utilizing the Lafayette motors plant adjacent to the present Nash plant. Machinery is now being installed and the big structure will be ready for use by spring. At that time the plant will be speeded up to capacity. New buildings and machinery will also be installed at Kenosha by which the capacity of plant will be increased by 25 per cent.

Nash will make about 53,000 cars this year, or 3,000 less than in 1923. Business has picked up steadily ever since Aug. 1, according to J. T. Wilson, vice-president. A record year is looked for in 1925.

The new Ajax car will come into production by March or April. A sample car has been completed and is being tested. It was planned to meet the demand for a cheaper car.

Machinery is being installed in the Ajax-Racine plant and it will have a capacity of 200 to 300 cars a day, or equivalent of 60,000 to 100,000 cars a year.

Auto Production Men Discuss Paint

Automobile production men in Detroit are interesting themselves in paint and its application as shown at their meeting Dec. 18. The advent of the nitto-cellulose or pyroxylin finishes as typified in the introduction of the DuPont product "Duco" has brought up anew the question of durability of various automobile finishes, and the methods by which they may be applied to save labor and inventory costs. H. C. Mougey of the General Motors Research Corporation gave the characteristics of good paint as first, the film must stick to the wood or metal; second, the color must be as desired; third, the lustre must be satisfactory, and fourth, there must be durability.

Questions of temperature and time were discussed in relation to adequate drying or baking, and such production details as the distance of the spray gun from the surface, the air pressure necessary and the type of nozzle found most effective, were gone into at length. George L. McCain of the Link Belt Co. presided over the meeting, which was well attended.

France Goes Right Ahead

Loans from America, both governmental and individual—The restless franc—Russia's ingenious idea—College entrants must have practical knowledge—The sad plight of Paris garters

By Our Paris Correspondent

IF ANYTHING is on the boom in France it is labor. More than ever there is a shortage manifest among all classes, except perhaps among the higher technical engineering branches. Production and trade are by no means in as healthy a condition, while the barometer of finance and politics is variable.

Foreign exchanges, above all the high priced dollar and pound sterling, are preventing any magnitude of orders being placed abroad except for necessities, though curiously, the money market has absorbed for weeks past all dollars and sterling offered and the success of the French loan in the United States has given at least a superficial encouragement to hope for better things.

To some extent this foreign cash is to pay bills already due abroad, still more to take up certain banking obligations and to some extent in making provision for food stuffs which are being contracted for abroad due to the French crop shortage of the ingredients of the staff of life. It is significant that French industry is also finding American financial assistance, as for instance the ten million dollar loan which has recently been taken up by an American financial group in favor of the Union d'Electricite of Paris.

Franco-German commercial negotiations which are hopped, and expected, to come to a head before midwinter, when some of the chief trade clauses of the Versailles Treaty become abrogated with respect to the two countries, form one of the chief supports of the hope of better times. Meanwhile the wobbling political situation is doing nothing of itself to stabilize things and the new interior French loan has by no means found the ready cash expected which is the exact opposite of the results achieved by the loan asked for, and received, in America. Possibly rising living costs have been the cause of this caution on the part of the small investor, but when the rapidly rising index figures of most raw materials of industry, as have been evinced during the past few months, are considered it may well be taken that the conditions are generalized.

Competition Possibilities

If the franc further depreciates wages will rise in all manufacturing industries and the fact is that they are about all the traffic will stand at the present time. The French metal, machinery and tool trades can not proceed much farther on these lines and keep production costs at a level that will enable output to compete with that of Germany, Belgium or Luxembourg in world markets, or even prevent dumping by the first mentioned. Inversely this still holds out little hope for increase of American exports to France, for regardless of rising French wage scale there is still to be reckoned the high priced dollar.

The year's imports of machinery and tools from America to date show an increase of the value of 102,079,000 francs over those of the same period of last year. Exports of similar items to the United States were valued at but 26,214,000 francs which, however, was an increase of a little over five million francs as compared with 1923.

If the French consumer continues to hold off as he has for some months general business will go back to the hand-to-mouth policy of 1920 which of itself will be bound to increase prices still further and hold out still less encouragement for imports from abroad.

There has been no appreciable drop in pig iron prices for many weeks and a general rise of 30 francs to 50 francs per ton is looked for on semi-finished steel puroducts and a like figure on tool steel. Machine wire has already risen 100 francs a ton in the past fortnight. Only various scrap metals, of which stocks are fairly heavy, show any fall in price.

Advance Orders Lacking

Lorraine plants are having difficulty in running at full head by reason of a lack of advance orders for more than a month ahead and almost all lines of manufacture using fabricated iron and steel are simply producing for stock, which means increased interest charges for the carry-over. Wire nails and small farm tools are in demand at profitable figures and the electrical equipment industries show a certain animation as a result of the nation-wide government electrification project now well under way.

The Russian Soviet government, as a result of the recognition by France, proposes to send—and France is apparently willing to receive them with open arms—two hundred engineering students. As a *quid pro quo* the Soviets are to buy for cash 2,000 French motor trucks. This is a new form of commercial exchange, of which the advocacy is to be doubted, but admittedly ingenious. It is supposedly of Russian origin as is the proposition for a Russian loan in France for 3 billion francs. The first proposition is comprehensible, but the latter—if it goes through—will certainly not enhance French credit with other nations.

A new entrance examination program has been put into effect by the *Ecole des Arts et Metiers* whereby students, to be acceptible, will first have to show a sufficient capacity to handle simple machine tools. For the engineering courses in metallurgy and the metal trades in general candidates must henceforth show that they have something more than "a nodding acquaintance" with the turret lathe and boring and milling machinery.

A novel method of marketing its automobile and wood and iron working machinery output in general is being adopted by the Société des Usines Renault by the formation of a company which will carry all its credit business with individuals. The working capital is one million francs, which seems little enough when dealing with units that run into fairly big sums to begin with. It represents one of the first visible attempts at separating the manufacturing and selling ends of an important industry of a like nature in France.

There has recently been advanced a government proposition for new labor legislation. It is stated that modifications of the existing law of 1892 are necessary as its operating clauses are in many respects insufficient to meet modern demands upon it. From 1893 to 1920 there were settled by conciliation 4,379 labor strikes out of a total of 23,711. The workers refused the award in but 81 instances, while the employers were responsible for 1,269 rejections, the remainder being accepted by both parties, either on the old terms or by mutually acceptible modification. New regulations are looked for to make conciliation a more easily arrived at method for settling labor disputes henceforth.

Restricting Names

A recent French customs decision is to the effect that no article may be imported into France that bears the descriptive name of France, French, or that of a French locality, city or town. This hits "Paris garters," to recall an article that will be recognized by all in a manner to show the futility, at least questionability, of the ruling. A Lyons lathe or miller, if made in Ohio, could not be called the Lyons Lathe, nor a cream separator called by the name of Normandy. The point should be recalled by American manufacturers. Up to date the ruling has more particularly affected watches and clocks and parts thereof and small tools and gimcracks imported from Germany or Switzerland, but if a Newburgh manufacturer of lawn mowers should choose to name one model "Dutchess" after the county it may not enter France without a further superscription and nomenclature to the effects that it is of American manufacture.

Railway freight rates to tidewater export ports have been under discussion by French machinery manufacturers recently. It appears that the reduced export freight tariff only applies to shipments of five tons and over.

Notes on Washington Activities

By Paul Wooton

Knowing that inflation booms inevitably are accompanied by an equal and opposite reaction, there is advocacy at this time that measures be taken to check the present upward swing. Such proposals are based on the assumption that the present situation is parallel to that of 1919. There is a feeling that the difficulties that followed the sharp upturn early in that year could have been lessened had proper steps been taken.

There are essential differences, however, between the present situation and that of 1919, it is pointed out. Inflation does not begin until the production machine is running at 100 per cent of its capacity. The situation can be judged by the speed of the production machine. In some few instances the 100 per cent point is being approached, but the fundamental industries are not operating at full time. For instance, the iron and steel industry is operating at 80 per cent of full time capacity; coal production is below 70 per cent of capacity, while the figure for textile manufacture does not exceed 75 per cent. There still is an available reserve of labor. Many of the employed are not working full time.

Since half of the impetus behind active business has its origin in public psychology, the present situation has confidence and optimism contributing to its support, but there are other factors working in the opposite direction. The tide has turned in gold imports and industry has not forgotten the lesson of years. Industry is inherently cautious. It thinks back in decided contrast to the stock exchange where retrospection does not penetrate for more than six months. Speculation and betting have nothing to do with the great processes of production and distribution, except as they have a psychological effect. The stock market is not an efficient interpreter of economic tendencies.

Attention is called to the fact that every reason exists for industry to be cautious. The situation must not get out of hand, as our economic structure will not stand again the strain of inflation and collapse.

American Institute Plans Activities

The American Institute of the City of New York, now beginning its ninety-seventh year of continuous effort for American Industry, announces through its board of trustees an activities program for 1925 that covers a wide range of work in the interest of the public. Many of the important problems of American industry, including Government control of radio and the management of the Patent Office, are scheduled for investigation by committees of experts appointed by the Institute. Partly in connection with this work, there will be public lectures and open forums for the purpose of informing the public concerning present-day industrial needs and abuses.

As a feature of its work in the interest of investors and inventions, the American Institute will hold an Exposition of Inventions next spring at the Engineering Societies' Building in New York. This is designed to afford inventors and companies owning or having developed inventions the opportunity of showing their achievements to the public, and to afford the public the opportunity of seeing and studying the current work of inventors. The opportunities the Exposition offers are of interest to both individual inventors and industrial and commercial commercial companies.

To make this service for invention continuous the Institute undertakes to act as a clearing house for information about inventions and related matters. The members of the Institute who are interested in invention and industrial development are further provided for by meetings at which individual problems and recent happenings are discussed.

As members of the Executive Committee of the Institute, Roberts Everett and L. W. Hutchins have been named to prosecute the activities of the Institute. Both men have had wide experience in the fields of organization, promotion and publicity. The offices of the Executive Committee are at 47 West 34th St., New York City.

Ferro Alloys Absorbed by Vanadium

The United States Ferro Alloys Corporation will be merged with the Vanadium Corporation of America, A. A. Corey, Jr., president of the latter organization, announced this week. The plan calls for the taking over of the entire control of the Ferro Alloys company's affairs, but its corporation organization will be maintained as in the past. Its office will be moved to the Vanadium headquarters in the Equitable Building.

Mr. Corey says the consolidation will effect a considerable saving in overhead expenses, as there will be but a single executive and selling organization. The Vanadium corporation has not hitherto produced ferro-alloys. The plants of the Ferro Alloys Corporation are at Niagara Falls, N. Y.

New Wire Plant for Sparrows Point

The construction of a rod and wire plant has been started at the Sparrows Point plant of the Bethlehem Steel Corporation, according to an announcement by Eugene G. Grace, president of the company.

The new mill will produce rods and a full line of wire products, including plain and galvanized wire, wire fencing, nails, etc. The plant, according to Mr. Grace, will have a capacity of 120,000 tons annually, with a working force of approximately 600 men.

The Bethlehem Steel Corporation acquired a wire plant when it took over the Cambria Steel Co., but it did not have the capacity to meet the demand, according to Mr. Grace. The Sparrows Point plant not only will be located to give better service to the Eastern wire market, but will be able to take advantage of economical water rates to the Atlantic seaboard, Pacific Coast and foreign ports.

Foundation Plans Research Work

The appointment of 190 leading engineers, representing industry, education and public service in twenty-seven cities throughout the country, to act as local representatives of the Engineering Foundation, with national headquarters at 29 West 39th Street, was announced by Chairman Charles F. Rand.

These engineers, the announcement stated, will work with the Foundation Board in carrying out a Nation-wide plan "for the furtherance of research in science and engineering or for the advancement in any other manner of the profession of engineering and the good of mankind."

In referring to plans for future development the announcement of Chairman Rand states that "as it approaches the end of its first decade the Foundation looks forward to a future of greater service with the united support of the engineering profession, of the industries and of individuals who have built fortunes upon engineering."

The Foundation's work will be carried on with $500,000 provided by Ambrose Swasey of Cleveland, augmented by a recent gift of $50,000 from the estate of Henry R. Towne. The immediate direction of the Foundation's affairs will be in the hands of a group of prominent engineers in New York and other cities.

At present, according to the announcement, the Foundation is cooperating with the National Research Council and the Research Committees of the various engineering societies in investigations of various engineering problems.

Cost of Living Gains

According to a comprehensive survey of the cost of living in the United States for Nov. 15, 1924, just completed by the National Industrial Conference Board, the weighted increase of all items combined was only one-tenth of one per cent between Oct. 15, and Nov. 15, 1924. All of the separate items included in the cost of living showed variations in this period.

Between July 15, and Nov. 15, 1924 there was an average increase of 2 per cent in the cost of living. This change was occasioned by increases in the average cost of food, clothing, fuel and sundries, and a decrease in the average cost of shelter. The average cost of light, which had been slightly lower during this period, had returned in November to the level of July, 1924.

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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BUSINESS men usually spend the week between Christmas and New Years in taking stock and ascertaining the result of the year's operations. To most American merchants the showing for 1924 ought to be satisfactory. Taking the United States as a whole Uncle Sam's account current with the rest of the world would stand about as follows:

To the debit of the U. S. and the credit of foreigners:		
Foreign Loans publicly floated		$1,165,000,000
Foreign Loans and Credits privately arranged, say...		500,000,000
American investments abroad, say		325,000,000
Net imports of gold, say....		250,000,000
Interest paid on foreign loans, say		750,000,000
Total Debits		$3,000,000,000
To the Credit of the U. S. and the debit of foreigners:		
Excess of merchandise exports over imports, estimated at $1,000,000,000		
Interest on foreign loans accrued and collected,	750,000,000	1,750,000,000
Net increase in foreign credits in U. S. during 1924		$1,250,000,000

Of course there are many invisible transactions that are not included in the above and those that are included are nothing more than rough estimates, but they make it clear that the items passed to the credit of foreigners in the United States during the year 1924 probably exceed the debits by about $1,250,000,000.

To this sum there should be added the credit balances due foreigners at the beginning of the year, plus any remittances since made and less any withdrawals during the year. The net total of these running credit balances is presently estimated at from one to three billion dollars. Taking the lower figure it would appear that the current balances held here for foreign account are not less than $2,250,000,000 and that this amount is presently subject to withdrawal upon demand despite the fact that a much larger sum is due the U. S. from abroad on long time obligations maturing years hence.

In other words this country is in the position of a bank that has discounted a customer's note. Upon the expectation that the borrower will meet the note at maturity he is at libery to withdraw its proceeds when placed to his credit.

This somewhat elementary statement of the country's external financial position is submitted because the facts it discloses are fundamental in their bearing upon the security and commodity markets as well as upon the course of trade generally.

The optimistic sentiment engerdered by the election has swept the country and has been effective in advancing prices because our large gold reserves have made credit abundant and cheap. It is possible that the impetus the upward movement has acquired will sustain and advance the markets for a while, even though money should become dearer. But in the long run high interest rates chill speculation and restrain business. For this reason it will be well to remember that foreigners have enormous credit balances here upon which they can draw at will and for the same reason the gold movement, bank reserves and interest rates will be the things to watch in the immediate future.

What's Doing in Industry

While sales of machinery and machine tools have been light during the past week, plans for better business during January and February are being made and indications are that the industry will have the busiest two months that it has enjoyed for some time past.

Many announcements of expansions have been made by railroads, locomotive builders, general industrials and others, and all of them will mean increased equipment, most of it of the latest and most improved type.

Inventories at the automobile factories have slowed down machine tool sales in the Detroit district, but the promises held forth by the motor car builders have kept alive the enthusiasm of the machinery men in Michigan.

Railroad buying was light during the past week with the Lehigh Valley, Southern R.R., Chesapeake and Ohio, and the Baltimore and Ohio purchasing single tools. The Chicago, Milwaukee and St. Paul Ry. closed on equipment for its West Milwaukee car shops.

Christmas sales in the retail stores proved to be record breaking and business generally is satisfactory, with car loadings reported fairly good and other barometers indicating reasonable prosperity for the next few months at least.

Last week Mr. Hoover announced that we might expect that Russia would take $125,000,000 in gold annually from this country for several years. Sterling is gradually moving upward. In England there is a confident hope that specie payment will be resumed in the spring. Holland, Sweden, Switzerland and Germany are now on a gold basis. The East Indian demand for the yellow metal is apparently insatiable.

Our gold exports for December promise to be $40,000,000 or more. This sum is not in itself significant, but if it shall prove to be the precursor of a movement sufficiently large to reduce the reserve ratio of the Federal Reserve Banks to 50 per cent a general advance in the money market would be almost certain to follow and the exhilaration now prevailing would be tempered by the higher cost of credit and the scrutiny to which loans are always subjected when interest rates are advancing.

The weekly statement of the Federal Reserve System gives point to these observations, but the changes reported will not be commented on this week as they may be in part due to the holiday demand for cash, especially gold "pocket pieces." But the money market is somewhat higher, nevertheless. Call loans touched 5 per cent on last Tuesday. That rate was not maintained, but acceptances are no longer salable at less than 3 per cent and time money as well as commercial paper are distinctly higher. In consequence there are many who look for an early advance in the rediscount rate and rumors that it had been ordered found ready credence.

But it is possible to be too far sighted as well as too short sighted in studying business conditions and from the foregoing it should not be inferred that any immediate or sudden change in the present trend of the markets is indicated. Buoyancy is still general and, while bonds are quieter and stocks yield a little more easily to selling pressure, there is no evidence of real weakness.

Among the commodities the metals have been conspicuously strong. Copper is up to 15 cents. Steel is again higher and lead, tin and zinc have continued to advance. As formerly the chief buyers have been the railways and the public utility companies who use electrical equipment. Continued improvement in the demand for lumber is also reported from the Pacific Coast and railway car loadings are again beating the record at this season of the year.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

The last week of 1924 found the Chicago machine tool trade in a condition which, generally speaking, may be termed hopefully expectant. Nothing extraordinary is looked for, but developments during the last two weeks, with an increasing number of inquiries coming in, seem to warrant the expressed belief that the year 1925 will witness a revival in manufacturing and producing industries employing machine tools and other machinery, and that concerns contemplating plant enlargements and an increased production over 1924 will make their requirements known in detail not later than the middle of January.

Replacement of old and obsolescent tools, deferred as long as possible by conservative and cautious manufacturers, will figure as one factor in the machine tool market next year, another being the increased output that is predicted as certain to follow. This confidence is based on the prosperous condition of the country as a whole, and machine tool dealers are correspondingly optimistic. An official of the Link-Belt Co. in the course of conversation with the writer gave a very encouraging forecast for 1925. This company, whose operations cover the United States, and extend into Canada, and whose opportunities for gaging business conditions are exceptional, believes that the first six months of 1925 will witness a great improvement over the same period of the past year. Business has steadily increased for the last several months, and, it is believed the machine tool market will experience a decidedly favorable reaction before many weeks pass.

Cincinnati

Manufacturers in Cincinnati state that there has been an increase in the number of orders booked since Dec. 1. While it is true that plants are not operating on as heavy a schedule as they should under normal conditions, many executives state that they are pleased with the trend of business. They feel that the present improvement in production is but the forerunner of better business in the early months of the coming year, a feeling in line with business in general.

Most of the orders that have been placed in the last two weeks were for single machines. The volume of sales was most gratifying to the manufacturers. Inquiries have been brisk and many of them are expected to materialize in generous orders in the next month.

Automobile manufacturers are buying slightly more machinery than they have been for a number of months. Orders from this field, however, have not been as numerous as they should be, but machine tool men believe that considerable increase can be confidently looked for in the coming weeks.

Railroads have been conservative in their purchases and have bought only immediate necessities lately. It is not considered likely that they will be in the local market to any extent until after the first of the year.

Large Cincinnati plants state that they are operating on a bigger scale than during either October or November. Specially designed machinery has kept several of the plants busy. Lathes and milling machines are bringing fair sales at present. Electrical tool manufacturers state that their production has held up well and that the automotive field is still offering them a good outlet for their products.

Little change has occurred in the woodworking machinery market in which plants are running at normal capacity to fill current orders. The same is true in the production of conveying machinery. The employment situation reveals that there are more skilled workmen employed than was the case several weeks ago. Foundries are fairly busy.

Canada

The holiday season has failed to put a damper on buying in the metal markets of eastern Canada. Satisfactory orders have been received during the last two weeks from manufacturing sources and evidence continues to point to a more active market after the first of the year. Good business has obtained in iron and steel warehouses, particularly in reinforcing bars, small shapes, and mild steel bars. The old material market is much stronger, and there is evidence that more business is developing.

There are sound reasons for the belief that the automobile industry, or at least the passenger car portion, is in a position to enter 1925 with more favorable prospects than have prevailed during the last two years. From an output of 972,000 car units in the first quarter of 1924, production was cut down in the June quarter to 834,000 passenger cars. In the September quarter another decrease to 749,000 units was recorded. This second cut recognized the seasonal fluctuation and afforded elbow room to clean up the excess of production created during the third and fourth quarters of 1923 and the first three months of 1924.

Cheering news for machinery manufacturers is contained in a recent survey of prospective expansion among the mines of northern Ontario that shows that many millions of dollars will be spent on mills and mill supplies within the next year. According to this survey mill expenditures reaching a total of $7,350,000 are contemplated. The plant of Charles Walmsley & Co., Ltd., situated at Longueuil, Quebec, is busier than ever before. Work is proceeding nearly twenty-four hours a day, and sufficient orders are now on hand to keep the plant going at the present rate for the next eight or nine months. The shops of the Canadian Car & Foundry Co. shipped during the month of November, one storage battery car for the International Equipment Co., to be used on the Temiskaming and Northern Ontario Ry., but in the past month, no further orders for railway equipment have been received.

Milwaukee

As might be expected, the period between the two holidays was dull almost to the point of stagnation in the metalworking machinery trade, but compared with a year ago, the sentiment permeating the circle of manufacturers and dealers as well was considerably improved. Prospects for 1925 business are regarded with a great deal of hopefulness, and it seems likely that the trade will begin to feel the beneficial effect early this month.

If the business of foundries and machine shops develops as it is confidently believed it will, the demand for machine tools should outrank that of last year and two years ago by a good margin. Metalworking shops have been doing relatively little buying for about two years, and if the demand was confined to bare necessities alone, the volume would amount to a considerable quantity. The prospects that metal trades business will undergo expansion make the future appear even brighter.

While the automotive trade has been probably most prominent among machinery buyers, and it will, doubtless, continue to be a big factor in 1925, the inclination is towards a belief that the railroads will furnish a substantial part of the business. Buying from this source has been negligible and it can not hold back much longer without serious impairment. One of the largest local users of metalworking machinery is the West Milwaukee locomotive and car shops of the Chicago, Milwaukee & St. Paul system, and if, as now seems likely, financing will be successful, this group will be a strong tool market factor in the year now opened.

The used tool situation appears to be more favorable than it has been at any time since the war, because offerings have dwindled and there has been general absorption of supplies. The trade has some distance to go in order to get to what is called a normal point in respect to used machinery

stocks, but the extreme pressure noticeable during most of 1923 and 1924 has been to a great extent relieved.

Detroit

Machine tool and machinery dealers in Detroit and the other automobile centers of Michigan are eagerly looking forward to the days when Detroit will be the Mecca for technical men from all sections of the country who will attend the annual convention of the Society of Automotive Engineers.

From present indications the present month will be one of the best periods experienced by local machinery men, as large orders are expected to be placed either before, during, or after the convention which is being held in Detroit for the second consecutive year.

Most of Detroit's large industries have for some time been running steadily. Manufacturers — especially those in the automotive field—are measuring production by consumption. Antomobile manufacturers are centering their efforts on designing and building economical closed cars. The closed car established its dominance over the open type in October, when closed car production exceeded open for the first time in the history of the automobile business. It is very likely, a survey shows, that this ratio will be continued from now on.

As a result of this increased demand for the closed car, especially the so-called coach, or the economical closed car, motor car executives are looking to the body builders. Extensions to the body plants, as well as consolidations, improvements in machinery, and greater production are expected.

Announcement has been made that the first metal airplane of the Stout Metal Airplane Co. of this city whose factory is located at Henry Ford's Dearborn Airport, has been purchased by the United States Post Office Department to be used in the carrying of Air Mail.

Indianapolis

While demand for machinery and tools remains somewhat spotted in this territory, the general trend of the market is toward expansion. Of course, the demand has been affected by seasonal influences. Many plants are preparing for inventories and naturally are cutting down their buying to actual needs. Immediately after the first of the year, however, the local trade is looking for an increase. Virtually every member of the machine tool industry here is sanguine concerning the new year.

At the present time the automobile trade is increasing its tool buying. Two of the local factories appear to have plenty of orders and one is working to capacity. The remainder, however, are operating on short schedules and are expecting but sub-normal business until spring.

A good demand is coming from the coal fields in the Western part of the state. Heavy machinery, particularly electric motors for hauling coal in the mine, new engines for hoisting and shop equipment are being purchased by those operators who can afford to replace old machinery. This business is expected to be very good if the coal business in general continues to improve. Some talk has been heard of a mammouth consolidation of coal interests in Indiana that would shut down all mines, but those actually necessary to take care of the demand. O. B. Iles, head of the International Machine Tool Co., reports a somewhat spotted demand. He is convinced, however, that business will improve by spring.

The railroad demand is good. The Pennsylvania R.R. recently re-opened a big shop here that has been closed for months. Buying is heavier, particularly in the tool business, with the railroads. Furniture factories continue to purchase special machinery, but the demand has fallen off during the last month. The volume of inquiries being received augers well for early spring, however.

Personals

ARTHUR L. GREENE, formerly with the Buffalo Forge Co., Buffalo, N. Y., is now with the Buffalo Bolt Co., Buffalo.

DANIEL O'ROURKE, who has been in charge of the Moffat Tunnel, Colorado, has resigned and will joined the organization of the Sullivan Machinery Co., Chicago.

SIGMUND G. ELBE, representative for many machine tool companies in Denver, Col., died recently in that city following a stomach operation.

O. M. BOSTWICK, the New York representative of the publicity department of the General Electric Co., and formerly advertising manager for the Sprague Electric Works, has tendered his resignation effective Jan. 1.

WILLIAM P. CULVER, vice-president and sales manager of the American Autoparts Co., of Detroit, has resigned.

C. A. ABLETT, who is the managing director of the Unbreakable Pulley & Millgearing Co., Ltd., Manchester, England, has been appointed managing director of the Cooper Roller Bearings Co., Kings Lynn, also.

LORD ASKWITH is the new president of the Institute of Patentees, Inc., 44 Great Russell St., London, W. C.

C. C. HERMAN, formerly chief engineer and general superintendent of the Litchfield Manufacturing Co., Waterloo, Iowa, is now a practicing consulting engineer with offices in Waterloo.

J. H. WARING, formerly chief inspector at the Milwaukee Works of the International Harvester Co., is now assistant superintendent at the Chicago tractor works of the same company.

D. J. NORMOYLE will represent the Stockbridge Machine Co., Worcester, Mass., in the Philadelphia territory. His headquarters are at 514 Liberty Building.

W. P. LESHURE, formerly president of the Hampden Grinding Wheel Co., Springfield, Mass., has become general manager of the Leshure Co., 55 Governor St., Springfield, Mass.

F. C. MERRICK, vice-president and general manager of the Canadian Westinghouse Co., Hamilton, Ont., has been elected vice-president and general manager of the Westinghouse Electric and Manufacturing Co., East Pittsburgh. E. M. HERR, president of the company, will move his offices from East Pittsburgh to New York City.

JOHN A. O'BRIEN has been elected president of the Seaman Kent Co., Ltd., Canada. Mr. O'Brien is vice-president and managing director of M. J. O'Brien, Limited, Ottawa, Ont.

R. R. SYMINGTON, who for the past four years has been secretary-treasurer of Western Steel Products, Ltd., of Winnipeg, has been appointed vice-president and managing director of the company. He will succeed H. C. McMartin who is retiring after twenty years of service with the company.

T. N. ANDREWS, JR., formerly manager of the Boston branch of Robert H. Hassler, Inc., shock absorber manufacturers, has been made treasurer and general manager of the company. Mr. Hassler also announced the appointment of N. K. Jones, until recently Indiana branch manager, as director of sales. Andrews succeeds Edward Springer and Jones succeeds George K. Bryant, both of whom resigned.

E. C. MORSE, general manager of Wills Sainte Claire, Inc., of Marysville, Mich., has announced his resignation.

S. A. ARMSTRONG, vice-president and general counsel of the Sanford Riley Stoker Co. of Worchester, Mass., has transfered his offices from Detroit to Toronto in order that he may give more active direction to the Canadian interests of that company.

R. V. DUDLEY of the engineering staff of the Ford Motor Co., who has been in charge of the Ford developments at Iron Mountain, Mich., has been recalled to Detroit to resume his duties as part of the Ford executive staff.

GEORGE F. DRAKE has recently taken over the entire holdings of the Drake Lock-Nut Co. For the past eight years he has been vice-president and general manager of the company.

J. W. RUPERT has been appointed works manager for the A. C. Spark Plug Co., Flint, Mich.

Business Items

The Thrall Electric Co., Cuba, will be the representatives in Cuba for the Foote Bros. Gear & Machine Co., Chicago.

The Pawling & Harnischfeger Co., Milwaukee, has changed its name to the Harnischfeger Corporation. The officers of the corporation are: Harry Harnischfeger, president and treasurer; Arthur G. Hendricks, vice-president and general manager; Walter Harnischfeger, vice-president; and Rene von Schleintiz, secretary.

The McNamara Motor Wheels Ltd., recently incorporated in Canada with a capital stock of $300,000 is establishing a plant at St. Mary's Ontario. The Provisional directors of the company include Russell E. McNamara, executive director; Berton E. Seymour, financial director; W. A. McNeill, president; Glen W. Slater, secretary-treasurer.

The New York offices of the Louis Allis Co., Milwaukee, Wis., have been moved from 345 Madison Ave. to 8 E. 41st St.

The Miles Machinery Co., Saginaw, Mich., has purchased the entire equipment of the Simplex Wire Wheel Co., Cadillac, Mich.

The Leshure Co., 55 Governor St., Springfield, Mass., has been formed for the purpose of manufacturing bakelite, rubber and silicate process grinding wheels.

Fire destroyed the plant of the Vincent Steel Process Co., Detroit, a coal and lumber yard, the factory of the Michigan Republic Gear Co., and seven oil sheds of the Motor City Oil Co., Dec. 20. Partial estimates by Ralph E. Vincent, and officials of the other companies affected by the blaze, show that the total damage will approximate $500,000.

The plant of the National Motors Corporation at Dayton, Ohio, has been sold at a receiver's sale for $250,000. Will I. Ohmer, former officer and director of the company, was the purchaser.

The Starr Equipment Co., Arrott Building, Pittsburgh, Pa., is the representative in that territory for the Stockbridge Machine Co., Worcester, Mass.

The D. E. Morand Machinery Co., 8,784 Quincy Ave., Detroit, Mich., is the representative of the Stockbridge Machine Co., Worcester, Mass., in the Detroit district.

The Puros Co., Denver, Col., has completed two new acetylene plants, one at Los Angeles, Calif., and the other at Oakland, Calif.

The factory and general offices of the Norma-Hoffman Bearings Corporation have been moved from Long Island City, N. Y., to Stamford, Conn., where a modern plant has just been completed.

Will Simplify Types of Machine Knives

Following a preliminary study of problems arising from the wide range of dimensional varieties of machine knives, conducted in co-operation with the Division of Simplified Practice of the Department of Commerce, manufacturers have voted to organize a simplification committee, of which George Butterfield, of the Knife Information Bureau, Fitchburg, Mass., is secretary.

One of the principal duties of this committee will be to secure the co-operation of manufacturers of knife-using machinery toward standardization so that progress may be made in reducing the variations which now cause knife producers to turn out so many different sizes.

Trade Catalogs

Shapers. Gould & Eberhardt, Chancellor Ave., Newark, N. J. The shapers made by this concern with the new features are described in this catalog recently mailed out to the trade. There are many half tone illustrations and diagrams show the interior construction, the floor plan for setting up and there are many specifications.

Alloy Steels. The Central Steel Co., Massillon, Ohio. The development of alloy steel and the method of production at this particular plant are outlined in this booklet recently issued. The many new uses that alloy steel is being put to are enumerated, while drawings serve to aid in the visualization of the narrative.

Turrets. The McCrosky Tool Corporation, Meadville, Pa. How the McCrosky turret has been a factor for saving in big plants where mass production is demanded is told in a four-page folder. Exceptionally clear photographs show the turret attached to lathes and also show the component parts of the turret.

Motor Starters. The Monitor Controller Co., Baltimore, Md. The Monitor Thermaload Starter, made by this company, is described and explained in a new perforated booklet just out. The principle upon which the starter works and the advantages of its mechanism are explained. Illustrations show the parts of the starter as well as the assembled product.

Sheet Metal Working Tools. The Niagara Machine & Tool Works, Buffalo, N. Y. Plans for vocational schools are given in this booklet recently issued by the above named company. The equipment necessary for a vocational school, especially the sheet metal shop, are listed and partially described. The publication is known as Circular No. 103.

Slate and Marble Drill. The Hisey-Wolf Machine Co., Cincinnati, Ohio. A special tool for work on slate and marble has been made by this company and a page bulletin has been mailed out describing it. The best methods to use in operating the drill are set forth and an illustration shows the implement.

Diesel Engines. The Fulton Iron Works, St. Louis, Mo. How the Diesel engine is used in medium powered central stations and the economy of such usage is told in an interesting way in this booklet. The waste of coal energy and its high cost are emphasized.

Turret Lathe. The Warner & Swasey Co., Cleveland, Ohio. The No. 4 Universal turret lathe made by this company is described in a recently issued catalog. The centerpiece of this catalog is a clear picture of the machine tool with reference lines to each important part. It differs from ordinary pictures of this kind in that the wording may be clearly read and the lines rapidly traced as no lines cross. The work that the machine will do as well as other interesting text is included.

Pistons. The Aluminum Company of America, Pittsburgh, Pa. This publication is called a reference book for dealers, salesmen, garagemen, mechanics and repairmen, and there are outlined many phases of aluminum pistons including the advantages of aluminum pistons, the design and machining of pistons and other data.

Sanitary Drinking Fountains. The Century Brass Works, Belleville, Ill. This is catalog "L" and a wide variety of drinking fountains for workshops and outside use are shown and described therein.

Valves and Fittings. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Catalog No. 43B showing the H.P.M. hydraulic valves and fittings has been issued. Many different products are shown in the booklet and descriptions cover adequately the various styles and types. Diagrams, tables of specifications and other data are included.

Welding Flux. The Chemical Treatment Co., 26 Broadway, New York City. The work that the Weifex iron or steel welding flux will do is told in a booklet sent out by this company. Many firms have tested the product and predict a future of usefulness for the flux.

Electric Equipment for Cranes. The General Electric Co., Schenectady, N. Y. The subject is discussed thoroughly in this booklet with particular reference to crane motors, controls, brakes and other parts. Information is given on operating characteristics and types of standard motors are listed together with other valuable data.

Circuit Breakers. The Roller-Smith Co., 233 Broadway, New York City. Bulletin No. 530 describes a line of circuit breakers intended to cover the entire range of requirements in the air break circuit breaker field. Ratings, catalog numbers and list prices for the various breakers are included and there is also a useful table showing the ampere capacity necessary in breakers to be used for the protection of motors from 1 to 100 horsepower.

Pamphlets Received

Prices and Cost of Living. Published by the Government Printing Office, Washington, D. C. The booklet is made up from the report of the Bureau of Labor Statistics for the month of November, 1924, and contains many comparison tables showing the variance of price of food products and other commodities.

The Problems of Highway Finance. Report of the Committee of the National Tax Association and presented at the annual convention held in September in St. Louis. Published by the office of the secretary, 195 Broadway, New York City. The report of the committee has been incorporated into a pamphlet of twenty-one pages and mailed out to members and others interested in the subject.

The Annual Report of the Commissioner of Patents. United States Department of the Interior, Washington, D. C. This report covers the fiscal year ended June 30, 1924, and was recently mailed out. The report covers only five pages, but in addition there are statistics showing number of patents applied for, those granted, and other data.

The National Museum of Engineering and Industry. Engineering Societies' Building, 29 West 39th St., New York City. The proposed museum to be built as an extension of the Smithsonian Institute, Washington, D. C., is described in detail in this booklet. What other nations have done in this line is also told at some length.

Forthcoming Meetings

American Association for the Advancement of Science. Meeting at Washington, D. C., Dec. 29, Jan. 1, 2 and 3. Burton Livingston, Smithsonian Institute, Washington, D. C.

American Society for Steel Treating. Winter Sectional Meeting under the auspices of the Cincinnati chapter. Thursday and Friday, Jan. 15 and 16, in Cincinnati.

Society of Automotive Engineers. Annual Meeting. Detroit, Mich., Jan. 20, 21, 22 and 23. C. F. Clarkson, 29 W. 39th St., New York City.

American Management Association. Annual Convention. Hotel Astor, New York City, Jan. 28, 29 and 30. Headquarters, 20 Vesey St., New York City.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Firmness continues in pig-iron prices despite seasonal slackness of demand. This is due mainly to advances in wages at the coke ovens. Heavy melting scrap is up about $1.75 per ton. Cold drawn steel is 10c. per 100 lb. higher at New York warehouses compared with a week ago. Discounts are smaller on shop supplies such as: bolts, nuts, rivets, washers and screws.

Non-Ferrous Metals—Tin and zinc prices at new high for the year. Copper market firmer, with steadily advancing prices. Lead rising gradually with little sign of a change in direction. Slight rise in fabricated brass and copper products consequent to the general advance in non-ferrous metals.

(All prices as of Dec. 26)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	22.77
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.25
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.26
Virginia No. 2	30.17
Basic	23.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.45	4.40	4.15	4.30
Nos. 22 and 24	3.50	4.45	4.20	4.35
Nos. 25 and 26	3.55	4.50	4.25	4.40
No. 28	3.60	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75	4.60	....	4.50
Nos. 12 and 14	3.85	4.70	....	4.60
Nos. 16	4.00	....	....	....
Nos. 17 and 21	4.15	5.00	....	4.90
Nos. 22 and 24	4.30	5.15	3.00	5.05
No. 26	4.45	5.30	4.15	5.20
No. 28	4.75	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.75c.; 5/32 to ¼, 7.25c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7½c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.50
Tin, 5-ton lots, New York			58.50
Lead (up to carlots), St. Louis	10.25	New York	10.75
Zinc (up to carlots), St. Louis	7.70	New York	8.62½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	16.50	16.00	16.25
Copper sheets, base	22.12½	21.87½	22.12½
Copper wire, base	20.12½	20.50	20.75
Copper bars, base	21.37½	22.37½	22.62½
Copper tubing, base	24.50	25.50	25.75
Brass sheets, base	18.87½	19.00	19.25
Brass tubing, base	23.50	24.75	25.00
Brass rods, base	16.87½	18.12½	18.37½
Brass wire, base	19.37½	20.00	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.75	12.00	11.37
Solder (½ and ½), (case lots)	40@41	35.00	33.50
Babbitt metal (83% tin)	60.00	66.00	50.00
Babbitt metal (35% tin)	28.00	20.00	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.50@11.75	11.25	12.00
Copper, heavy, and wire	11.25@11.50	11.00	11.50@11.75
Copper, light, and bottoms	10.00@10.25	9.75	10.50
Heavy lead	7.00@7.25	6.75	8.00
Tea lead	6.00@6.25	5.25	6.75
Brass, heavy, yellow	7.25@7.50	7.00	8.00@8.25
Brass, heavy, red	9.00@9.25	9.25	9.75
Brass, light	6.25@6.50	6.00	6.75
No. 1 yellow rod turnings	7.75@8.00	7.00	8.00
Zinc	4.00@4.25	3.75	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.09@.14½	.18	.09½@.12¾
Wiping cloths, 13½x13½, per lb	.11@.11¼*	36.00 per M	.11
Wiping cloths, 13½x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.17	1.15	1.25
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	60%
Second grade	50–10%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0405	.044
Brass rods	per lb	.1687½	.1612½	.155
Solder (½ and ½)	per lb.	.40@.41	.40@.41	.3375
Cotton waste	per lb.	.14@.21	.14@.21	11@14
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		4.25@4.50
Coke, prompt foundry, Connellsville	per net ton		4.50@5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ¾-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
⅝-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1⅛ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened, ¼x¼-in., 6c. each, less 50%.

Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1⅛ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

D. C., Wash.—A. L. Flint, Genl. Purch. Officer, The Panama Canal, takes bids until Jan. 5, for saw filer and setter, chisels, drills, drill chucks, metal-slitting, saws, etc., also until Jan. 12, bending and straightening machine, shaper, molder and flanging clamp.

Mass., Beverly—R. Robertson Co., Chicago steel brake No. 4.

Mass., Boston — Boston Stove Exchange, 53 Merrimac St.—pipe cutting and threading machine, 2 in. and over.

Mass., Boston—J. F. Prince, 132 Broad St.—bench drill press, saw table and lathe.

Mass., New Bedford—A. W. Jenness, 104 Elm St.—general equipment for repair and service garage.

Mass., Somerville—M. E. Barnes, 99 School St.—miscellaneous tools and equipment for garage and service station.

Mass., Westfield—S. Simkowitz, 246 Elm St.—tools and equipment for garage and repair shop.

Mass., Worcester—S. Johnson, 506 Park Bldg.—tools and equipment for service garage and repair shop at 81-85 Chandler Street.

Tex., Tehena—C. L. Seat—machinery for box, crate and hamper plant.

Vt., Windsor—Windsor Foundry Corp.—sheet metal brake for 16 gage stock, 36 or 48 in.

Wash., Bramerton—U. S. Engineers Office, receiving bids Feb. 4, electric crane.

W. Va., Huntington — A. C. Love Co., manufacturers of mine, mill and contractors equipment—1 modern extra heavy duty engine lathe, 20-in. to 24-in. swing, 6 or 8 ft. between centers, with taper attachment.

Wis., Green Bay — Northwestern Engineering Works, Howard and South Pearl Sts.—additional drilling machines, chain hoist, etc.

Wis., Burlington — Holmquist Curtain Stretcher Co., (manufacturers patent curtain stretcher), P. C. Holmquist, Purch. Agt.—woodworking machinery.

Wis., Milwaukee—Crucible Steel Casting Co., 612 Clinton St., A. Lange, Pres.—modern foundry equipment and crane.

Wis., Monroe—The Monroe Auto Co., E. Keel, Mgr.—equipment, bench tools, etc., for proposed machine and repair shop.

Wis., Neopit—E. A. Allen, Supt., Menomonee Indian Tribe—saw mill equipment and machine shop tools.

Opportunities for Future Business

Calif., Los Angeles—A. M. Castle & Co., 453 South Spring St., have taken over plant of Little & Robertson Co., at 37th and Alameda Sts., and plan additions to double capacity of present plant for manufacture of steel. Estimated cost $40,000.

Calif., Oakland — Fageol Motors Co., 107th Ave. and Hollywood, awarded the contract for the construction of a second unit addition to present plant. Estimated cost, $17,000.

Ill., Chicago—Porter Estate, c/o H. N. Rose, 385 South Dearborn St., having plans prepared by Foltz & Brand, 510 North Dearborn St., Archts., for the construction of a 7 story and basement, 48x154 ft. garage at 606 South Wabash St. Estimated cost, $200,000.

In., Marshalltown—The C. A. Dunham Co., 230 East Ohio St., Chicago, Ill., manufacturer of steam heating specialties, will take bids about Jan. 20 for a 2 story, 50 x 150 ft., factory, on East Main St. Estimated cost $75,000. H. E. Reimer, Kibby Bldg., Archt. Noted May 8.

Me., Mt. Desert—C. H. Millikin, c/o J. F. Kelley, 39 Center St., New Haven, Conn., archt., is having plans prepared for the construction of a 1 and 2 story, 45 x 110 ft. repair, service garage and store room. Estimated cost $50,000.

Mass., Boston—L. Altman, 119 Massachusetts Ave., is having plans prepared for the construction of a 1 story, 115 x 110 ft. repair and service garage on Blue Hill Ave., Dorchester. Estimated cost $50,000. F. A. Norcross, 216 Cornhill St., Archt.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Mass., Boston—P. J. Brady, 3722 Washington St., Jamaica Plain, awarded the contract for the construction of a 1 story, 125x45 ft. repair and service garage at Washington and Tower Sts., Forest Hills. Estimated cost $50,000.

Mass., Boston—Commonwealth of Massachusetts, Dept. Correction, State House, S. Bates, Comr., plans the construction of an industrial building for the Charlestown State Prison. $430,000 appropriation asked. Engr. and Archt. not selected.

Mass., Boston—H. I. Shackley, c/o Mulhall & Holmes, 33 Newbury St., Archt., is having plans prepared for the construction of a 4 story 70,000 ft. floor space garage on 18-20 Deerfield St. Estimated cost $200,000.

Mass., Salem — J. J. Harrigan, Beverly St., plans the construction of a 2 story, 110x40 ft. repair and service garage on Jefferson St. S. H. Fanning, 221 Essex St., Archt.

Mass., Woburn—Woburn Degreasing Co., is receiving bids for the construction of a 1 story repair and service garage on Bedford St. Estimated cost $40,000. Private plans.

Mich., Detroit — The Campau Estate, Cass and Baltimore Aves., awarded the contract for the construction of a 3 story and basement garage, 118x155 ft. Estimated cost $150,000. Cass-Baltimore Garage Co., lessee.

Mich., Detroit — Pittlekow Heating and Engineering Co., 312 West Kaebed St., has awarded the contract for 2 story 70x80 ft., shop and office. Estimated cost $50,000.

Minn., Albert Lea—C. D. Edwards Mfg. Co., manufacturers road machinery, are having plans prepared by Goorder & Goorder, for the construction of a 1 story 80 x 200 ft. factory. Estimated cost $50,000. R. D. Edwards, Secy.

Mo., St. Louis—Huttig Sash & Door Co., 1200 South Vandeventer Ave., will build by day labor a 2 story and basement, 50x125 ft. addition to mill. Private plans.

N. C., Charlotte — A. Kahn, 1000 Marquette Bldg., Detroit, Mich., will soon award contract for the construction of a 5 story, 100x200 ft. automobile sales and service building at Trade and North Graham Sts., for C. C. Coddington, Inc., West Trade St., Charlotte.

O., Vermilion—Wakefield Brass Co., awarded the contract for a 1 story, 60 x 160 ft. plant, recently destroyed by fire.

Okla., Oklahoma City—Hughes Tool Co., 300 Hughes St., Houston, Tex., awarded the contract for the construction of a machine shop. Estimated cost $15,000.

Pa., Clearfield — Gerhar Knitting Machine Co., awarded the contract for the construction of a 4 story, 32x32 ft. factory. Estimated cost $50,000.

Pa., Phila.—F. A. North Co., 1306 Chestnut St., manufacturers of pianos, is having plans prepared by Amos W. Barnes, Perry Bldg., Archt., for the construction of a 5 story and basement, 28x178 ft. repair shop. Estimated cost $175,000.

Pa., Phila. — Walworth Mfg. Co., 245 Arch St., plans the construction of manufacturing building for steam supplies on Hunting Park Ave., near Fox St. C. E. Wunder, 1520 Locust St., Archt.

Tex., Tehena—C. L. Seat, will soon receive bids for the construction of box, crate and hamper plant. Estimated cost $25,000. Private plans.

Wis., Green Bay — Northwestern Engineering Works, Howard and South Pearl Sts., awarded the contract for a 1 story, 22x180 ft. addition to machine shop. Estimated cost $25,000.

Wis., Madison—Madison Motor Car Co., 325 West Gorham St., awarded the contract for the construction of a 3 story, 60x210 ft. garage and repair shop. Estimated cost $150,000.

Wis., Milwaukee—Crucible Steel Casting Co., 612 Clinton St., A. Lange, Pres., plans the construction of a 1 story, 150x350 ft. foundry on 11th Ave., also a 2 story pattern vault. Archt. and Engr not selected.

Wis., Neopit—E. A. Allen, Supt., Menomonee Indian Tribe, will build 2 story, 64x95 ft. saw mill, by day labor. Private plans.